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Hong Kong secondary school teachers' computer attitudes, beliefs and use of the technology in teaching

Hong Kong Secondary School Teachers' Computer Attitudes, Beliefs and Use of the Technology in Teaching

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Abstract

Hong Kong Secondary School Teachers' Computer Attitudes, Beliefs and Use of the Technology in Teaching

This multi-trait research study investigated Hong Kong secondary school teachers' computer attitudes, their computer use in class and their beliefs about the use of information technology. A convenience sample of 229 secondary school teachers of both sexes and of different age groups teaching across various subject categories. returned a questionnaire, which included the Computer Attitude Scale developed by Loyd and Gressard. The teachers' beliefs about computer use in teaching were triangulated with an individual interview with frequent teacher computer users.

The gender of, and subject category taught by, the respondents had a significant relationship to the computer attitudes (anxiety, confidence and liking) and the frequency of computer use in class. Age did not significantly affect the computer attitudes overall, but there was a significant relationship between the age and the frequency of use of the female respondents.

The majority of respondents expressed the view that the main impediment to using the technology was lack of time for planning. Despite that, 70% of the teachers often or sometimes used the technology in teaching. Both in the questionnaire and the interview study, respondents expressed their appreciation of the benefits of the instructional use of IT. However there was a discrepancy between the survey and interview data concerning their beliefs about the changes in the role of the teacher and the student with the incorporation of the technology in class. It reflected the difference between the teachers' expectations and their perceptions based on their experience.

The use of applications was confined to a few categories: PowerPoint, Internet search and Word Processing. The types of applications utilised, the interviewees' experience about the roles of the teachers and students, their reasons and perceived advantages of using the computer all reflected that IT was used to maintain current teaching practice rather than transform the pedagogy. Further studies are needed to investigate how the technology can be harnessed to bring about more effective learning in response to the new demands of this changing world.

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It has been a long, tortuous journey with times of frustration and uncertainty. I am thankful that God's unfailing promises have sustained me throughout. He has given me sufficient strength to endure all the little tests, which, I believe, have worked to refine my character.

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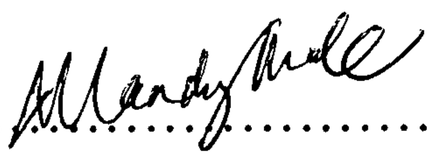
My heartfelt thanks are to everyone who has made this thesis a reality.

DECLARATION

I declare that the work in this thesis was carried out in accordance with the Regulations of the University of Bristol. The work is original except where indicated by special reference in the text and no part of the thesis has been submitted for any other degree.

Any views expressed in this thesis are those of the author and in no way represent those of the University of Bristol.

The thesis has not been presented to any other University for examination in the United Kingdom or other countries.

Signed ..... 

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Chapter 1 Introduction

Machines have enabled man to transform his physical environment. With their aid he has plowed the land and built cities and dug great canals. These transformations of man's habitat have necessarily induced mutations in his social arrangements. But even more crucially, the machines of man have strongly determined his very understanding of his world and hence of himself.

-Joseph Weizenbaum, (1976)
Computer Power and Human Reason: From Judgment to Calculation

1.1 Introduction

This introductory chapter addresses the background of the present study with a survey of the IT Policy in Hong Kong and its implications for Hong Kong teachers. It next brings into focus the purposes of the study, the research areas and the research questions.

1.2 Background of the Study

1.2.1 IT Policy in Hong Kong

The financial crisis hit and rocked Hong Kong in 1997 in the midst of an overheated property market. The stock market crashed; the prices of property plummeted. The downturn has awakened many Hong Kong people to the stark reality of the vanity of a bubble economy. The SAR government has come to realise that its economy could no longer rest on the property market. The world has entered a new epoch: an information technology age. There should be a restructuring of the SAR economy in the face of the global *e-volution*. The SAR government has decided to lead the territory towards high technology development or it will further lag behind other countries.

To develop an economy based on hi-tech entails a strong back-up from the educational sector. The SAR government is indeed bent on developing information technology in education. Four missions are clearly laid down in the policy document, Information Technology for Learning in a New Era: Five-year Strategy 1998/99 to 2002/03, issued in1998:

> We must ensure that we provide the necessary education to our students so that they can grow up with the vision and the capability to rise to new challenges. We issued a five-year strategy on IT in education in November 1998. The four key components of our strategy on IT in education are to enhance our students' access to IT and the Internet, to provide training and support for all teachers, to use IT to support teaching in the school curriculum, and to foster a community-wide culture which helps promote IT in education. The government will assume a leadership and co-ordination role in promoting IT in education.

In 1997, the government announced a series of IT initiatives costing $2880 million in capital cost and $260 million in annual recurrent cost. It would provide computers and Internet access to all schools, offer training places for primary and secondary school teachers, prepare for an education-specific Intranet and a pilot scheme in 10 primary and 10 secondary schools. It was intended to bring the provision level of 40 computers per primary school and 82 computers per secondary school by mid 2000. In 1998, a further set of initiatives at an additional capital cost of $334 million and annual recurrent cost of $294.5 million was announced, including deploying an IT coordinator per school for 250 schools, rendering enhanced technical support for all schools, etc.

One chief component of the Five-year Strategy is teacher enablement. By 2000-01, it was intended that teachers would have reached at least the 'basic' level of IT competency and by 2002-03, about 75% of teachers would have reached the

'comfortable' level, about 25%, the 'competent' level and one to two teachers in each school, the 'creative' level. Hence, about $514 million has been set aside for providing some 80000 IT training places for serving teachers.

1.2.2 Implications for Hong Kong teachers

In the last couple of years, the front-line teachers in Hong Kong have been introduced to educational innovations one after another. Teachers are subject to greater demand for accountability, school self-evaluation, external school review, etc. brought about by the marketisation of education (Education Commission Report No.7, 1997). Starting from 1998, all except about 100 secondary schools in Hong Kong have to use Chinese as the medium of instruction (CMI). In other words they have to change the medium of instruction from English to Chinese. What is more, a new policy has been passed requiring all English and Putonghua (Mandarin) teachers to be benchmarked by the year 2006 through sitting examinations or taking courses (Circular Memorandum No.29/2000 from the Education Department). Now here comes the IT policy. The intensification of work for teachers is beyond measure.

The IT policy has created an enormous impact on the serving teachers especially those who have been in the profession for a number of years. Many of them did not grow up in the computer age and the policy indeed has created in them an indescribable fear and a sense of insecurity. I have heard of teachers talking of taking early retirement because the changes they have to face are really overwhelming. Their fear is understandable because unlike many other changes, many teachers have to start from scratch with the new initiative. They also realise that IT is not another add-on in teaching. It should ultimately induce a change in their work culture, their teaching style and also their own lifestyle.

Some teachers, on the other hand, are sceptical about the policy. They see this as another top-down policy imposed on them by the government. The whole business has been viewed as one begun without an overall comprehensive plan. For example, some schools and teachers were anguished about the government dispatching nearly a hundred computers to each secondary school, creating an immediate problem of where to place this equipment.

Some are also critical about the differential access to the government funding. As instigated in the policy document (Information Technology for Learning in a New Era: Five-year Strategy 1998/99 to 2002/03) the government will "provide extra facilities for schools with a higher level of IT-readiness. Indeed the 20 pilot schools and a number of other schools have been or will be provided with more facilities." (Section 8.12)

The government admits that it does not see a strong IT culture in our campuses, and most teachers have little experience in using IT to teach. Thus it is committed to providing a wealth of hardware and IT training to teachers. Its vision is to "bring about a paradigm in the delivery of school education-from a largely textbook-based teacher-centred approach to a more interactive and learner-centred approach"(Section 8.1). However, it is indeed doubtful whether the paradigm shift it is so keen to bring about is so much dependent on the provision of technical know-how and hardware alone. The change process involves far more considerations than these, which are much easier to address. Areas like the teachers' affective domain, their pedagogical beliefs, the amount and quality of support on how to integrate technology with their subjects, etc are crucial components.

The IT policy has been implemented for a few years. Against this backdrop, I wished to embark on my inquiry in the implications of the policy for secondary school teachers in Hong Kong.

1.3 Purposes/ Significance of the Study

In the face of the IT policy, it has been expected that students in Hong Kong or even novice teachers should feel more "compatible" with information technology because they have been brought up in the computer age where computers have become an integral part of their life. But the impact should be strongly felt by those who have been in the profession for quite a while. In view of this, I engaged in investigating the secondary school teachers' attitudes towards and use of computer technology in the classroom.

There were several reasons for targeting teachers. In the first place, teachers, as implementers on the frontline, have a strong influence on the success of the reform. As Fullan and Hargreaves (1992) have pointed out, "There are things that teachers value, that they want to achieve through their teaching. There are also things that they dis-value, things that they fear will not work or will make matters worse." (p.5) However, innovations are often introduced in schools with only superficial attention given to teachers. The profundity of the change process that they experience with innovation is often misunderstood (Hope, 1997). Thus we need to look into the emotions teachers have about the impact of the innovation, their perspectives on the change process, etc. because they are the key players in educational reforms.

Secondly, most teachers grew up in an educational setting where the traditional mode of teaching was used and where IT was not fully employed either in their school days

or in their pre-service professional training. The impact of the IT policy on them cannot be ignored and is worth studying. Harrel (2000) has found that the amount of computer use by students is related to the instructors' self-confidence and their perceptions about the effect of computer technology on quality of education. Thus we need to look into the teachers' attitude and readiness to use the computer.

Thirdly, previous research of this kind has not been carried out on Hong Kong teachers and so I was interested in trying my hand at it. It was hoped that the findings would shed light on the suitability and adequacy of training, support and incentive rendered to the key players of the reform and possible recommendations in the future.

1. 4 Research Areas

In my study, I sought to look at the average computer attitude and usage rate of the secondary school teachers in Hong Kong. Gagne and Briggs (1974) define an attitude as "an internal state which affects an individual's choice of action toward some object, person or event." (p.62). It was expected that the teacher's attitude towards technologies in teaching to a certain degree predicts his/her use of the computer. We cannot measure the success of computer use in the classroom without gauging the affective factors of the users. Therefore, I wanted to investigate the average computer anxiety, confidence and liking of the secondary school teachers in general and see whether these attitudes significantly predict their use of the technology in the classroom.

I would also explore how gender, age and subject taught relate to the computer attitude and computer use of secondary teachers. It is important to see if the use of

computer and the computer attitude are related to gender in the Hong Kong setting since generally speaking, there are relatively more females than males in the teaching profession. Moreover not so many studies have been conducted on how age and subject taught are related to computer attitude and use, so I would also like to look into these areas. Many of the teachers were not taught with IT when they were students. Would it be an impediment to the use of computers? Does age have an inhibiting effect on computer use? As the computer has always been masculinized and is more related to some subjects than others (Gardner, McEwen & Curry, 1986; Hawkins, 1985), the relationship between the subject taught and computer attitude and use was also my interest area. For example, is there any difference in the computer attitude and use of IT between the language teachers and the science teachers? I believed these findings would also shed light on the adequacy and suitability of the on-going training given to the teachers.

Apart from the affective aspect, I intended to look into the beliefs of the teachers about computer use in teaching and the obstacles they encounter in the process of integration. Hawisher and Selfe (1991), in Evolving Perspectives, promulgate that "...we must create generations of educators who see both the problems and the potential associated with technology, and who are committed to critical thinking about computer use within our education system." (p.276) To ensure successful integration of the technology into the classroom, the implementers' beliefs about IT must be examined. Are the secondary school teachers in Hong Kong in line with the literature when it comes to benefits and changes in roles concerning computer use in the classroom? Do they perceive any drawbacks in using the technology?

Finally, in my study, I also examined how the teachers use the technology in their

teaching. To see whether IT is appropriately employed for quality teaching, it is not enough to investigate whether teachers use it or how often they use it. We should also examine how they use it. Maddux, Johnson and Willis (2001:2) express this clearly: "After all, the computer is a tool, and, like any tool, it can be poorly used or misused." Computers cannot improve organizational performance unless they are used appropriately. In the light of this, my study explored how teachers of different subjects use the technology, whether usage is subject-bound, whether the potential of the computer is well capitalised on, etc.

1.5 Research Questions

A. What are the average computer attitude scores of secondary school teachers in Hong Kong?

B. What is the relationship between gender, age, main subject category taught and the computer attitude of the secondary school teachers of Hong Kong?

C. What is the usage rate of IT of the secondary school teachers of Hong Kong?

D. What is the relationship between gender, age, main subject category taught and the frequency of use of IT of the secondary school teachers of Hong Kong?

E. What is the relationship between computer attitude scores (anxiety, confidence and liking) and the frequency of use of IT ?

F. How do various schools differ in terms of average computer attitudes and usage rate?

G. What are the main problems encountered by secondary school teachers in using IT?

H. What are the secondary school teachers' views of the benefits of using IT?

I. What are the secondary school teachers' views of the changes in the teacher's and the student's role with the integration of IT in teaching?

J. What do the secondary school teachers think are the drawbacks of using IT in teaching?

K. What are the secondary school teachers' reasons for using IT in teaching?

L. How do teachers use computer applications in teaching their subject categories?

1.6 Chapter Summary

The implementation of IT Policy in Hong Kong has had a strong impact on the teachers of Hong Kong. Many have perceived it to upset their status quo. Some are sceptical about the effectiveness of the innovation because it does not seem to address the fundamental needs and concerns of the teachers. Teachers are important agents of the change process and so they were studied in the current research. Firstly their computer attitudes and use in the classroom were measured. Secondly, the study investigated how these are related to gender, age and the subject taught. Thirdly, the teachers' beliefs and perceptions about the instructional use of technology and the obstacles they encounter were probed. Finally, the research examined how the teachers actually apply technology in their teaching.

Chapter 2 Literature Review

2.1 Introduction

This chapter first reviews literature about the significance of information technology to modern education in a global sense. It then examines the benefits of the technology to education and the roles of the teacher and the student in a technology-mediated classroom in literature. Studies on the educational use of technology in certain subject areas and the correlations between use and attainment are reviewed. This is followed by an account of previous research on variables affecting computer attitudes and use. Finally, literature on impediments to teachers' incorporating technology in education will be surveyed.

2.2 The Significance of Information Technology to Modern Education

2.2.1 Mass Schooling ---the Demise of Individualization in education

The Analects (11,21) documented the following event. When Tzu-lu asked whether he should immediately put into practice what he heard, Confucius asked him to consult his father and elder brothers first. When Jan Yu asked the same question, the Master answered, "Immediately carry into practice what you hear." More than three thousand years ago, Confucius realised the importance of teaching according to the abilities, learning styles and dispositions of the learners. Thus, he gave contradicting pieces of advice to Tzu-lu, who was impulsive, and Jan-yu, who was slow and retiring (Chen, 1993).

Another great teacher, Socrates, is also renowned for his attention to individual needs through the use of dialogues to inspire his students to learn through questioning and self-discovery. The teacher does not tell things, but he leads the student to understand using "a series of carefully formulated questions" (Taylor 1980:55).

With institutionalization, however, modern education has become decontextualised and dehumanised. For administrative convenience rather than for effective learning outcome (Forsyth, 1996), some thirty to forty students are placed in a physical classroom to be taught by the teachers. With large-group instruction in formal schooling, the didactic approach is often adopted and it is difficult to take into account individual differences and learning styles in this setting (Nickerson, 1988). Considering the amount of attention paid to individual needs, formal schooling of the modern time has in fact put the clock back. Davis, et al also spell out the problem that the classrooms become “working compromises in mass education systems" where teachers are made "managers of learners rather than managers of learning" (1997:21).

2.2.2 Information Technology and the Paradigm Shift

We have seen how individual styles and needs have been compromised in this production line of the modern schooling mill. In fact, the shortcomings of formal mass education are exposed with the rapid advance of information technology in education. The Internet and the computer have made the concept of teaching as telling obsolete. Human knowledge ceases to be seen as "an amorphous mass", which can be imparted to the learners by the teachers. The knowledge explosion induced by modern technologies hastens a shift from the old paradigm of "teaching as telling," from "the expectation that education provides the basis of a job, to an emphasis on education and training as a lifelong process" (Forsyth, 1996:16). It is in this setting that the Internet has a significant role to play.

2.2.3 Knowledge Construction using information technology

In the last few decades, research done by constructivist educationalists has yielded

theories which defy the behaviourist notion of learning as change in actions. The behaviorists view knowledge as an objective entity, which can be memorised through the same path by every learner. They believe knowledge exists as an external mass. However, with the advent of the computer age, we find ourselves "thrown" in an era of information explosion. Even if significant learning through memorization were possible, we cannot remember all the incessantly expanding information of this world.

Unlike the behaviourists, the constructivists see learning as an active construction of knowledge by the learner. The learner is in control of his own learning. He constructs his own perspective of the world based on his schemata, his individual experiences (Marlowe & Page, 1998; Roblyer, 2003). Learners are co-constructors of knowledge, who can make sense of things themselves and have the power to seek knowledge and understand the world (Oldfather, West, White & Wilmarth, 1999). Thus, knowledge is constructed through a process of social interaction and negotiation and what is learned cannot be separated from how it is learned (Geisert & Futrell, 2001; Jonassen, Peck & Wilson, 1999).

Against the backdrop of constructivism, Jonassen, Peck and Wilson (1999) mention technologies as tools to support knowledge construction. Students learn with teachers. If aptly utilised, information technology can allow the learner to become a participant, not a spectator, (Geisert & Futrell, 2001; Piaget, 1977; Poole, 1997; Taylor, 1980) in discovering knowledge. Feurzeig (1988) argues that when computers are used to create highly motivated learning environments, students can learn through “playful activities” as “practitioners.

2.2.4 Distributed Intelligence

In line with the constructivist view of education is the idea of distributed intelligence. It is a prevalent idea that intelligence is a property of the minds of individuals. Pea (1993) criticises this traditional notion of "solo" or "solitary intelligence". He contends that intelligences are distributed "across minds, persons, and the symbolic and physical environments, both natural and artificial" (p.47). This echoes Gregory Bateson's (1972) idea that memory is half in the head and half in the world. In a similar vein, Perkins (1993) argues that the person-solo is not lifelike. Learning has to do with how people appropriate and master tools for thinking and acting and he refers to this as the person-plus system.

If learning consists in the knowledge residing in the solo mind, then the computer surely can do a better job than the human mind. Education should be seen in the new light in which cognition is distributed across the mind and other cultural artefacts. Teachers should

> re-orient the educational emphasis from individual, tool-free cognition to facilitating individuals' responsive and novel uses of resources for creative and intelligent activity alone and in collaboration. (Pea p. 81)

Therefore, the computer should be used, not undervalued, as a useful cultural artefact, an "intellectual tool" (Davis, et al 1997;Vygotsky, 1978) in learning for activity alone and in collaboration.

2.3 The Computer as a Catalyst for Educational Change

In the first place, so much emphasis has been put on the ability to memorise and regurgitate facts to pass examinations in traditional schools. The continuation of this modality of learning and teaching by no means meets the demands of the rapid-changing world. "Knowledge" can become "obsolete" long before the student

graduates from school. Thus we cannot adequately equip students for tomorrow's workforce by just teaching them the absolutes, the specifics. The essence of education is the process, not the product, the skill development, not content acquisition (Crane, 2000; Schauer, 1992; Taylor, 1980; Tiene & Ingram, 2001). In other words, the formal school should be viewed as "one stage of a lifelong learning process", and we should provide students with the "tools and attitudes that will facilitate the communication of that process" (Nickerson 1988:295). One significant intellectual tool can be the computer.

Secondly, information technology has challenged us to redefine knowledge (Schauer, 1992; Scrimshaw, 1997) and stimulate working in multi-disciplinary projects (Merrill, et al, 1997; Stockhammer 1992). In modern times, it is increasingly difficult to "constrain a subject area within the curriculum to a given set of concepts and facts. Subjects will not be able to be 'packaged' as neatly as they have been in the past " (Tiene & Ingram 2000:28). The traditional "time invariant" contents of school curricula should give way to an interdisciplinary curriculum because it fails to meet the needs of students in a complex, technologically advanced, interdependent world (Crane, 2000; Feurzeig, 1993; Schauer, 1992).

Hence, gradually we are witnessing the breakdown of subject barriers, the loss of boundaries between fields (Malcom, 1988) to better reflect real-life situations (Roblyer, 2003). For example, the emergence of integrated humanities has seen the breakdown of the boundaries of subjects like geography, history, economics, etc. The language curriculum can involve project work that requires the student to search for, organise, synthesise and present information about genetically modified food, an issue traditionally subsumed under Biology. The approach and content of learning is

being re-modified and Scrimshaw (1997) describes the computer as at the heart of this change.

Not only are there the redefinition of knowledge and the breakdown of subject boundaries, the wall between the school and the world outside has also been opened through the Internet. Tiene and Ingram (2001) mention the collapse of insularity and the school's extending its mansion beyond its own four walls. Parents and the community also have more access and understanding about what is happening inside the school community. For example, parents can get to know more about the school activities through the school web and the school profiles are all posted on the Internet. Consequently, schools become more open to external changes and influences through networking and get more involved with the local community.

2.4 Benefits of Using Information Technology in Education

2.4.1 Catering for Different Learning Styles---Importance of Senses in Learning

Researchers have found that different students have different learning styles (Poole, 1997; Tufte, 1990). The traditional method of "chalk and talk", which requires the students to sit still in the lesson, in fact disadvantages learners of certain learning styles. Many, however, see the use of information technology as, to a certain extent, an antidote to the ignorance of the individuals by providing for different learning styles (Merrill et al, 1997; Poole, 1997; Taylor, 1980; Turkle, 1985). It offers "graphics, images, animations, quick-time movies and real-audio sound." Gardner (1993) proposes that the most effective instruction incorporates all seven intelligences, which do not operate independently. rather they complement each other. Therefore, the variety of activities and appeal to different senses in the use of

information technology can cater for the needs of different learning styles, and provide chances to "reinforce the intelligence strength and improve the weaker ones" (Crane 2000:123).

2.4.2 Enhancing Learners' Motivation and Interest

It is believed that the computer can be used to create motivating learning environments (Feurzeig, 1988; Grandbastien, 1992; Malcom,1988; Nickerson,1988; Tiene & Ingram, 2001). The colourful images presented, together with sound and moving images, capture the attention of students better than the traditional chalkboard. Abstract concepts can be more effectively explained through movable 3D objects on the screen. Virtual scientific experiments can be repeated endless times through simulations. In Stradling et al.'s survey (1994) on 563 students, a greater commitment to and time spent on school work has been reported. Studies conducted by Abbott (1997, 1998) have shown that pupils with special needs chose to spend many hours working on web page material to improve their work. In a recent study measuring the motivation of pupils through 15 case studies (Comber et al., 2002), IT was perceived to encourage students to become more focused on the task and to enhance performance and cognitive functioning.

2.4.3 Facilitating Cooperative Learning

Much research has revealed that cooperative learning leads to improvement both in student achievement and interpersonal relationships. It can foster higher intrinsic motivation, a more positive attitude toward instruction and instructors, the development of leadership abilities, a sense of teamwork, improved self-esteem, greater acceptance of differences and decreased dependence on the teacher (Crane 2000; Slavin, 2000).

Crane (2000) has suggested that information technology and cooperative learning should be merged to enhance learning effectiveness. A study by Peters (1996) provided paired keyboards linked to each computer and this approach was reported to have provided considerable support to pupils who would otherwise have struggled. In Henderson et al.'s study (2000), considerable evidence of acquisition of cognitive skills was reported with collaboration around computers. Some researchers even argue that group work around the computer may be more genuinely collaborative than other group work (Davis, et al 1997; Poole, 1997). Nevertheless, as McMahon (1990) has remarked, good collaboration in classrooms is only possible if the teachers are able to plan for and manage the process effectively. According to Crook (1998) successful collaboration requires explicit orchestration.

On the other hand, computer technology can also carry the idea of cooperative learning beyond the formal setting of the classroom. Working with the computer facilitates connectivity with students in other parts of the world (Crane, 2000) though this does not necessarily mean they are cooperating.

2.4.4 Improving Interactivity

The use of computer technology is deemed conducive to interactivity, engaging students more steadily in the classroom. Davis, et al (1997:25) express the idea in their article:

> The degree of interactivity in the software---whether it be through extensions and modifications of the task in response to the learner, or through the demand on the learners to decide upon appropriate questions for interrogating an information bank, or through the tangible products of creativity (in writing, design work or music)---can also sustain a higher than normal degree of on-task engagement and 'mindfulness'.

Changing the traditional classroom to a more interactive mode enables students to

become more active learners, instead of passive sponges. They are more likely to become participants in the dialogue rather than be spectators (Taylor, 1980). Nevertheless, in a study exploring the impact on teaching of the use of interactive whiteboards, Glover and Miller (2001) have concluded that such technology is likely to have limited impact where teachers fail to appreciate that interactivity requires a new approach to pedagogy. Thus in order that students can tap the potential of working with technology, the teachers indeed play a vital role. Their pedagogical beliefs have to be reoriented in the first place.

2.4.5 Developing Critical Thinking Skills

John Naisbitt (1982) comments in his book Megatrends that the main ingredient for today's jobs will be information. "Information literacy" is required for a majority of jobs in today's world (Crane 2000). An information-literate person should be able to access, evaluate and use information. Online technology, requiring search and retrieval and communication of ideas and viewpoints to others, motivates students, develops their deductive reasoning and critical thinking, and reinforces concepts and information within a particular discipline (Crane 2000; Mendrinos, 1997; Sheingold & Pea 1987).

2.4.6 Learning by Doing and Constructing

As the work of Jonassen, et al (1999) suggests, technology can foster learning by providing a tool to support knowledge construction. In Connell's inquiry (1998) the pupils in the class where technology was consciously aligned with the guiding constructivist philosophy showed a marked and consistent increase in performance than those in the other, where the computer was used as a presentation tool, more in line with a behaviorist approach. Jones (2002:20) reports that "interacting with

dynamic geometry system can help students to explore, conjecture, construct and explain geometrical relationships." The use of computers to support constructive learning was also shown to be effective by Dreyfus and Halevi (1991). It should not be neglected, however, in all this research, that the teacher played a vital part in guiding students and managing the process effectively in order for technology to foster learning successfully.

2.4.7 Achieving Authenticity of the Task

Much recent work has suggested that a crucial determinant of cognitive learning is the authenticity of the task. Feurzeig (1988:98), criticises the gap between school and real intellectual work. "School curricula often present the standard subjects in an intellectually impoverished and uncompelling way, teaching ways of thinking and doing that are distinctly different from those used by practitioners." Therefore it is imperative that education should "ground" knowledge in "experience and in contexts of use".

To bridge the gulf between the classroom and the real world, Feurzeig continues, "computers can be used to create and support the knowledge sources, learning environments, and instructional tools necessary to foster this kind of cognitive development". Davis et al (1997) also mention that computer tasks can be more authentic than traditional tasks. Indeed, with the access of a wide range of information sources through the Internet, students can be exposed to learning opportunities which offer the kind of spontaneity and authenticity often unavailable in the contrived setting of the classroom.

In the same grain, Taylor (1980:60) explains that the computer can "amplify

everyday experiences. The computer can create worlds which are not available in convenient form for the students to play with and explore the possibilities." It helps create learning environments in which interconnections can be made in instructions and students can encounter problems that look like the real world (Malcom, 1988; Tiene & Ingram 2001).

2.4.8 Liberating and Empowering the users

Users of the computer might be liberated to concentrate on more important aspects of learning. In the section on distributed intelligence, I have discussed the idea that learning takes place often not in the person-solo, but also in the person-plus. Just as the notation for music, maps for land and the press for speech, the computer is an important intellectual tool to help learning and creativity because when used appropriately it "frees students to concentrate on higher order activities" (McFarlane & Rijcke, 1999). Computers can be used to "facilitate memory and hence release attention for thinking and reflection"; (Davis et al, 1997:16). "They permit creativity"; (Poole, 1997:144). It can mean new tools and opportunities for innovation. It can mean relief from the burdensomeness of certain mundane chores and the possibility of more time to do those things that really require a human touch (Nickerson, 1988).

Students can also be empowered through increased autonomy in the pace and content of learning. Computers can be used by students "on their own, as writing tools, as reinforcement of basic skills and for diagnostic tests" (Grandbastien, 1992). The typical courses are to force everyone to move at essentially the same pace, not allowing for individual differences. Though the computer is not a necessary component for variable student pacing, it indeed makes individualised pacing

convenient and commercially practical (Taylor, 1980).

2.4.9 Allowing Sharing of Teaching Materials

Collaboration is facilitated not only among students, but also among teachers. The computer can contribute to collaboration among teachers by allowing them to share their expertise more easily and thus increase the communication among them (Grandbastien, 1992; Poole, 1997). “Some of this might occur at a distance, across computer networks, but much of it might take place within the school building.” “This could make teaching a less isolated profession and, in that sense, might be a healthy phenomenon" (Tiene & Ingram, 2001:299).

2.5 IT and Attainment in subject areas

Many focused studies provide substantial evidence of the contribution made to learning by specific applications of IT especially with English, Mathematics and Science subjects. However, research reveals that at this stage the regular use of a wide range of IT resources in lessons is far from common (Cox and Webb, 2004a).

2.5.1 English

The most commonly reported use of IT is word processing. In Barker and Togessen’s study (1995), significant gains in phonological awareness and word recognition were reported by assessing the results of reading tests. Johnson and Trushell (1993) also found that when primary pupils composed with word-processing facilities, they were more prone to summarise and remove redundant information. However there are interesting studies which show word processing to have both positive and negative effects. One such study is that by Barker and Pearce (1995), who found that undergraduates made fewer punctuation errors but more passive constructions, not

appropriate for the context, when using word processing. Some studies (e.g. Mumtaz and Hammond, 2002) also revealed that word-processing was only used superficially with little opportunity for students to draft and redraft. It was considered a desk-top publishing tool or printer. Thus the power of word processing to support learning depends as much on how the tool is used as on the nature of the tool itself.

2.5.2 Mathematics

Research studies have shown that IT can have positive effects on learning different concepts and skills in mathematics; for example, skills involved in constructing mathematical models, hypothesising relationships, interpreting graphs and learning concepts of ratio and proportion (Jones and Tanner, 1997; Monaghan, 2001; Hudson, 1997; Hennessy, 2000; Dreyfus and Halevi, 1991; Johnson, 2000; Hoyles et al, 1991).

On the other hand, research also reveals that computers are still not fully integrated into mainstream curriculum. Clements (2000) observed that pupils were using computers only occasionally in the States. In the UK, the recent ImpaCT2 project (Harrison et al, 2002) indicated that a majority of students in Key stages 3 and 4 never or hardly used IT in mathematics lessons.

2.5.3 Science

IT is found to have a positive effect on many areas of attainment in science and unlike English, the types of IT use are much more closely related to specific concepts and skills and tend to be subject specific. In a study in Israel, Barnea and Dori (1999) reported considerable gains in the understanding of molecular geometry and bonding by pupils who were given access to three-dimensional modelling software.

Simulation was found to be a useful tool in teaching science concepts; for example, in applying knowledge of the growth curve of micro-organisms (Huppert et al,1998), in acquiring better conceptual understanding of physical and chemical processes (Trindade et al, 2002), in improving thinking skills and strategies such as classification and inference (Henderson et al., 2000); and in addressing specific alternative conceptions (Gilbert and Wattis, 1983; Driver et al., 1985; Tao and Gunstone, 1999). Research on other IT applications used in science lessons involve data logging (Barton, 1997), digital video editing (Reid et al, 2002), etc.

Evidence of the contribution of IT to improved learning is extensive but these benefits are dependent on the way in which the teacher selects and organises the IT resources, and on how this use is integrated into other activities in the classroom. Therefore the teachers and their pedagogical approaches are crucial components in effective integration of IT into teaching (Cox and Webb, 2004b).

2.6 Change in the Teacher's and the Student's Role

With the integration of information technology, teaching and learning may become more related and more independent at the same time, with more self-responsibility and self-regulation for the students. This process can change both teachers' and students' roles.

Many claim that the advent of information technology has changed the traditional notion of the teacher as being the imparter and source of all knowledge. In a sense he/she becomes less authoritarian. The Internet exposes students to a wide range of course material, so "gone is the need for the teacher to be the source of all knowledge," (Forsyth, 1996:31) to "funnel information" into the student (Schauer,

1992). The use of IT can be seen as "a threat to the teacher's unique role as a knowledge dispenser" or "knowledge provider" (Grandbastien, 1992; McFarlane & Rijcke, 1999; Poole, 1997; Somekh & Davis, 1997; Tiene & Ingram, 2001). The teacher will less likely adopt a didactic approach, but gain the freedom to function increasingly as "enablers of quality learning experiences" (Somekh & Davis, 1997:156).

On the other hand, in the technology-based classroom, learners can have more opportunities to take responsibility for their own learning. They can assume a more active role in the learning process. The learner is no more a "recipient" but a "participant", a "searcher" actively involved in the interaction not available in face-to-face teaching (Forsyth, 1996). The computer may reduce the dependency of students upon the teacher, enabling greater student autonomy (Samson, 1992; Scrimshaw, 1997).

As a result of this change in the nature of interaction, the roles of teachers and learners can sometimes become less distinct. Often teachers and students can become co-learners. Indeed the roles may even be reversed at times, as students find themselves having to explain their thinking to teachers (Davis, 1997).

Despite the importance of the facilitating role with technology-mediated learning environments, it is important that the teachers should not just pass the leadership role entirely to IT. There are significant areas in students' learning in which they need to retain a leadership role such as the planning, preparation and follow-up of lessons (Cox and Webb, 2004b). As discussed in the previous section, the benefits of the use of IT are dependent on the teachers and their pedagogical values. According to

research on how teachers practised using IT, the uses ranged from technology being used as a 'servant' to reinforce exiting teaching approaches, or as a 'partner' to change the way teachers and students interact with each other and with the tasks (ibid). Hence the teachers' knowledge of IT, their confidence in technology, their pedagogical beliefs, etc. all have a decisive impact on the roles of the technology, the students and the teachers per se in the classroom.

2.7 Computer Attitudes and Use

2.7.1 Gender effects

As far as the gender effect is concerned, most earlier research has found that males harbour more positive attitudes towards computers than females (Badagliacco,1990; Campell,1990; Shashaani,1993; Todman & File,1993). Todman and Dick (1993) have reported that there was a gender difference in the attitudes of primary school children and teachers and pupil-teacher attitudes were positively related. In Todman's longitudinal study (2000), there was evidence of a widening gap between mean computer attitude scores of female and male students in UK universities and female representation in the group at the high-scoring (computerphobic) end of the computer attitude scale increased from 1992 to 1998. In another longitudinal study, gender differences in attitudes were found towards computerisation among students at a liberal arts university in terms of the types of usage (Mitra, LaFrance & McCullough, 2001).

Rosen and Weil (1995) report a prevalence of computer anxiety in over 50% of primary school teachers. As most primary school teachers are female, they warned, this can create an educational environment consisting of many anxious, female introducers of technology. An educational environment that comprises an anxious

role model and gender-biased classroom practices will give unintentional reinforcement to the genderization of technology (Saunders, 1993). Brosnan (1998) also suggests that the unintentional reinforcement of gender differences in computer attitudes can only encourage the formation of a self-fulfilling prophecy that advantages computer literate (male) students and disadvantages computer illiterate (female) students.

Apart from attitudes toward the computer, earlier research has also elucidated the more frequent use of computers by males than females (Clarke & Chambers, 1989; Chen, 1986; LaPointe & Marinez,1988; Lockheed,1985a). Gerver (1989) observed that at all levels of learning about computers, women tend to be strikingly underrepresented. The results of Reinen & Plomp's comparative study (1993) of 21 countries have shown that computer use in the schools of many countries is dominated by men. They are concerned about the lack of female role models in class. Wilder, et al (1985) also report in their study gender differences in reaction to computers, in attitude, in use, and in experience. Consistent with the above studies, a finding in Becker's study in 1985 has indicated that men have greater personal involvement in computers. They tend to dominate the home computer for playing games and programming (Kiesler, 1985; Lockheed, 1985b). Lee (1997) studied one hundred secondary school teachers and has confirmed that men are more active in computing and their activity covers a wider range of tasks or applications than occurs amongst women. It is noteworthy that these studies were conducted quite a number of years ago. More current studies seem to suggest a movement away from this picture.

In recent years, some researchers have come up with different conclusions albeit a

multitude of empirical support for gender differences in computer attitude and use. Girls who have grown up with computer technology may not respond in the same way as those who met it later in their life. Jennings & Onwuegbuzie (2001) have found in their study that gender is not related to the college students' computer attitude and they suggest that gender differences may be diminishing with the equity of access to the computer. In his studies on undergraduates in Wales, Francis (1993,1994) has discovered no gender difference in the computer attitudes of the participants and suggested that gender stereotyping is non-existent. In Braak's study (2001), technological innovativeness, teaching a technology-related subject, and computer experience have been found to account for more variation in explaining the use of computers in the class than the computer attitude scale, general innovativeness, age and gender. He expounds that there is no gender difference if stereotyping is removed and computer experience is controlled. He explains that computer attitude is only indirectly related to gender and can change over time.

In summary, earlier research predominantly suggests that gender is a major factor influencing computer attitudes and use while more recent studies conducted from the latter part of the 1990s onwards seem to reveal a departure from the trend. The rapid development of technology, the emergence of the Internet Age, the dynamic change of the computer interface, etc. might all have worked to reduce the gender differences seen with earlier less accessible technologies. The current study undertook to target the secondary school teachers of Hong Kong. Many of them grew up in the classrooms where computers were non-existent or not so user-friendly. Now they are faced with the requirement to use IT in teaching in a much more technologically-enhanced world of the third millenium. It will be interesting to inquire whether gender and age will exert a significant influence on the teachers'

computer attitudes and use and if so, to what extent.

2.7.2 Age and Subject Taught

There is far less research on age and subject taught than on gender as far as computer attitudes and use are concerned. Some existing studies have established that age is not a strong variable. Todman & Dick (1993) report that there is no age effect on computer attitudes in primary school pupils. In Braak's study on secondary school teachers, he posits that the age variable is not significantly related to the class use of computers and has little explanatory power.

In some studies, age is identified to be related to computer attitudes but the relationship is not linear. In Jennings and Onwuegbuzie's study (2001) with undergraduates, age is determined to have a significant relationship with various dimensions of computer attitude. The youngest group of students reported less computer anxiety and higher levels of confidence than did the other age groups. However the oldest students reported the highest levels of computer liking. In the studies of Czaja and Sharit (1998) and Loyd and Gressard (1984b), the older participants had the lowest levels of computer-related anxiety while they showed less confidence about their ability to use the computers. Harrel's study (2000), on the other hand, has established that age is significantly related to the English instructors' self-confidence in using the computer.

Regarding the subject variable, a finding in Stevens's study (1980) was that 84% of teacher educators thought it should be mathematics teachers who take responsibility for teaching students about computers. Other studies have highlighted the fact that computing seems to be strongly associated with the scientific/mathematical end of

the curriculum and is hardly seen in the English department (Gardner, McEwen & Curry, 1986; Hawkins, 1985). In Weber & Kershaw's survey (1990), most of the respondents who were teaching computing were male. Of the computer coordinators surveyed, 70% of them had initial qualifications in mathematics or science. Russell (1989) also mentions an institutionalized bias against the effective use of computers by humanities teachers. According to Braak (2001) it is plausible that teaching a technology-related subject is responsible for explaining the teachers' use of computers rather than age or gender. Many of these studies were dated and it will be interesting to explore if this subject-specific concept is still prominent in the present study.

2.8 Problems associated with Using Technology in the Classroom

Grandbastien (1992) has carried out a study in France and learned that computers were still 'tools for specialists" for a lot of teachers in the 90s. The computers are mainly used for administrative activities. Teachers are able "to ignore these computers" (p.48). In the study about computer use in schools of the Netherlands, Brummelhuis and Plomp (1994) have found that computer usage depends very much upon the individual teachers and is not embedded in the curriculum of existing subjects. At the school level, hardly systematic integration of the computer has been found. Braak (2001) comments that the implementation of computer use in schools has not reached the level of "routinisation". In another research study conducted on student teachers, findings revealed that the student teachers' computer uses were much lower than what they themselves perceived (Wang, 2001).

Crane (2000) mentions the fear of change and commitment among teachers as a bottleneck of using the technology. Geisert and Futrell's remark (2000:318) brings

home the message: “technological innovations can die not on lack of merit but because of their challenge to the status quo.” When students begin to work independently on the new machines, it may bother some teachers that they are no longer the focal point of their classrooms (Tiene & Ingram, 2001).

Teachers may see the influx of IT threatening in the sense that "they may be concerned about not knowing enough how to work with the technology or may even be afraid of breaking expensive equipment. Some may surely be troubled that their students know more about the technology than they do" (Tiene & Ingram 2001:259). Teachers are reluctant to reveal to students their lack of computer skills (MacMillan, Liu & Timmons, 1997). Crane expounds this as the fear of appearing incompetent and the fear of the technical aspect.

In their report, Brummelhuis and Plomp (1994) argue that the hindrances are too few computers, insufficient usable software, lack of knowledge and insufficient time for introduction of the technology. Many teachers first “want to gain more knowledge about the possibilities of the computer for educational ends before substituting the security of their teaching routine by the insecurities which accompany the introduction of the computer” (Brummelhuis & Plomp p.298).

The findings echo those of Cuban (1986) and Bulkeley (1988) cited in Poole (1997). Teachers have inadequate opportunities for training and poor access to technology, strategies for implementation are thus often flawed. Classroom demands of various kinds---class size, heavy teaching schedule, other teacher responsibilities unrelated to teaching, and so forth--take away from a teacher's commitment to computer-based teaching and learning.

McFarlane and de Rijcke (1999) also pinpoint the impediment to the change imposed by the current educational practice and assessment procedures. The over-reliance on assessment of a fixed body of knowledge leaves little room for the open applications of IT.

In the late 90s, the Hong Kong government started to implement the IT Policy in schools. Under the Five-year Strategy, the government has made sure that schools are provided with computers and broadband connection to the Internet, teachers are to complete training in IT, curriculum resources and materials are produced and made available for online sharing and community support is enlisted to promote the use of IT in education. In the face of this huge educational change, Hong Kong teachers may encounter various obstacles in their circumstances. In order to effect utilisation of IT for improved learning, these stakeholders' beliefs and difficulties should be appreciated and this constitutes another research area of the present study.

2.9 Chapter Summary

The advance of the Internet is believed to bring about a paradigm shift in education. In this computer age, learning is redefined and the purpose of education is conceived in a new light. In this chapter, literature about the potential benefits of technology to education is reviewed. The apt use of technology is believed to increase motivation and interest in learning, enhance learner autonomy, improve interactivity and collaboration in learning, and so on. We have also seen studies on the application of IT resources in chief subject areas by teachers to attain improved learning. Nevertheless it is important to note that the benefits of IT are very much dependent on the teachers' pedagogical beliefs and values. On the other hand, research also reveals that the regular use of IT in the classroom is far from common and most

teachers lack knowledge of a wide range of IT resources.

In a technology-mediated learning environment, it is possible for teachers to move away from the didactic mode of teaching while more room can be given to students to become active constructors of knowledge although this is not automatically the case. In spite of the significance of the more active role of the students and the facilitating role of the teacher with IT, the teacher cannot just pass the buck to technology. The teacher's leadership in planning, preparation and follow-ups of lessons becomes far more important than ever.

The chapter also reviews research studies on the influence of gender, age and the subject taught on computer attitudes and use. Early studies suggest that gender is a predominant variable while more recent studies tend to reveal a watered-down effect. IT has always been associated with the science and mathematics domains by educators but evidence on the relationship between subjects taught and computer attitudes and use is not extensive. Relatively fewer studies have been conducted on the age variable and among those studies, the effect of the variable is inconclusive.

As mentioned above, successful incorporation to a great extent lies in the attitudes, knowledge and pedagogical beliefs and values of the change agent. Thus, the current study was undertaken to investigate Hong Kong teachers' computer attitudes and use; their beliefs and opinions about the innovation and the obstacles they encounter. The next chapter will focus our attention on the methodology employed to undertake the inquiry.

Chapter 3 Method

3.1 Introduction

This chapter discusses the two methods of data collection in my study---the questionnaire survey and the interview. For each method, it gives an overview of the participants of the study, the questions included, the instrument chosen, the coding procedure and the data analysis methods. The chapter also explains why the methodological triangulation was used.

3.2 Quantitative Study

3.2.1 Participants

Participants of the survey study comprised secondary school teachers of Hong Kong. A total of 305 questionnaires were sent out to teachers of thirteen secondary schools to fill in.229 completed questionnaires were returned, giving a response rate of 75 percent. The sample was chosen by the convenience sampling method. They were colleagues of the researcher's friends, church mates, and relatives who were secondary school teachers per se. Though a fairly large sample size was secured with the satisfactory return rate of the completed questionnaires, the non-representativeness in using the convenience sampling method should be admitted. For instance, the schools selected were of various 'bandings', which indicated different abilities in terms of student intake. However; all the schools in the sample were very well-established and no 'young' schools were included. The sample may possibly be skewed by the relatively high 'age' of the schools. Schools with a longer history can easily carry with them a set tradition and culture, which might have bearing on the implementation of initiatives.

53.3 per cent of the respondents of the questionnaire were female (n = 122) while

46.7 per cent were male (n = 107). They were spread across six age groups (28 or below, 29-34, 35-40, 41-46, 47-52 and 53 or above) with the modal range at the 29-34 age group (32.3 per cent).

Table 3.1 Age groups of the questionnaire respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<28	25	10.9	10.9	10.9
	29-34	74	32.3	32.3	43.2
	35-40	57	24.9	24.9	68.1
	41-46	45	19.7	19.7	87.8
	47-52	23	10.0	10.0	97.8
	>53	5	2.2	2.2	100.0
	Total	229	100.0	100.0	
Total		229	100.0		

The respondents were teachers of different subjects. Their main subjects taught were grouped into five main categories, namely, languages, sciences, social sciences, cultural subjects and others. 39.7 per cent of the teachers taught languages (Chinese, English, and Putonghua) as the main subject category. The teachers who taught social sciences (Geography, History, Chinese History, Economics, Social Studies, Integrated Humanities, etc.) as the main subject category accounted for 15.7 per cent, Sciences (Physics, Chemistry, Biology, Mathematics, Computer Literacy, etc.), 31.4 per cent, Cultural Subjects (Art, Design, Physical Education, Music, etc.) 8.7 per cent while other subjects, 4.4 per cent.

Anonymity of the respondents was assured and they were not required to give their name in the questionnaire.

Table 3.2 Main subject categories taught by the questionnaire respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	languages	91	39.7	39.7	39.7
	social sciences	36	15.7	15.7	55.5
	sciences	72	31.4	31.4	86.9
	cultural subjects	20	8.7	8.7	95.6
	others	10	4.4	4.4	100.0
	Total	229	100.0	100.0	
Total		229	100.0		

3.2.2 Questionnaire

The questionnaire was divided into three main parts. The first part consisted of demographic information about the respondents---gender, age, years of teaching experience, and the subject(s) taught in school.

In the second part of the questionnaire, the Computer Attitude Scale (CAS) first developed by Loyd and Gressard in 1984 was used (Appendix I). The instrument contains three 10-item sub-scales, assessing three constructs about computer attitudes: computer anxiety, computer confidence and computer liking. The first subscale, computer anxiety, focuses on the respondents' freedom from anxiety and fear of the computer. The second subscale, computer confidence, focuses on the respondents' confidence in ability to use or learn about computers while the third subscale, computer liking, measures the liking of computers or the extent of enjoying working with computers.

The scale developers Loyd & Gressard conducted a study on "the reliability and factorial validity of computer attitude scales" in 1984. The writers reported that

means, standard deviations and estimates of internal consistency (alpha coefficients) were calculated for each of the three subscales and for the total score. Correlations among the three subscales were computed and a classical factor analysis was conducted. The alpha coefficients from the analysis test were .86, .91, .91 and .85 for the computer anxiety, computer liking, computer confidence subscales and the total scale, respectively. The coefficients are good indicators of the homogeneity of each of the subscales. Thus the writers concluded, "The data suggest that this instrument is an effective, reliable, and convenient means of measuring student attitudes toward learning about and using computers"(1984a: 501).

The computer anxiety sub-scale contains statements like "Computers do not scare me at all." and "I do not feel threatened when others talk about computers. The computer confidence sub-scale contains statements like "Generally I would feel OK about trying a new problem on the computer." And "I'm not the type to do well with computers." The computer liking sub-scale is composed of items like "I think working with computers would be enjoyable and stimulating." and "I do not enjoy talking with others about computers." Some of the statements were positively worded, and others, negatively worded to check on the reliability of the responses.

The items were arranged for scoring on a five-point Likert scale, ranging from "strongly agree", through "agree", "neutral" and "disagree" to "strongly disagree". Item responses were coded so that a higher score indicated a higher degree of liking or confidence and a lower degree of anxiety.

The CAS is one of the most popular choices among researchers in the States and UK to assess computer-related attitudes among pre-service and in-service teachers. Other

computer attitude scales may also be good but not many are designed specifically for teachers. The statements in the scale were concise and readable, so the30-item scale usually "takes less than ten minutes to administer" (Loyd & Gressard, 1984a). Thus owing to the relevancy of the scale to teachers as subjects, the reliability of the scale and the convenience of use, the measure was selected for the present study.

One limitation of using this instrument could be that it was first developed almost two decades ago when the interfaces of technology were very different from those today. Computer anxiety might be understood in a different context. On the other hand, "old" though the instrument may seem, the statements are still valid today because they are all very open; for example, "It won't bother me at all to take computer courses.", "I would feel comfortable working with a computer.", "I would like working with a computer.", etc. (Appendix I). Consequently, the instrument not only has been widely used throughout the 90s, but is still used in the 2000s (Francis et al, 2000; Jennings & Onwuegbuzie, 2001). Moreover, to complement the survey data, the interview study was also intended to elicit a more contextual portrayal of the teachers' use of technology.

The third part of the questionnaire was concerned with the teachers' perceptions about the use of computers and their actual use of the computer in teaching. Two open-ended questions were designed to gauge teachers' perceptions about the benefits of using IT in teaching and the changes in the role of the teacher and the student. The other questions were on the teachers' major difficulties in integrating IT into teaching, their frequency of using IT in teaching and the most frequent applications they used in their lessons.

A cover letter was included in every questionnaire, briefly introducing the researcher, explaining the purposes and significance of the research study being undertaken, making an appeal for help, assuring confidentiality of the information and showing gratitude for the kindness involved. The questionnaires were returned to the researcher mainly through the contact or via the self-addressed envelope attached.

3.2.3 Coding

The interview data were coded and keyed into the SPSS spreadsheets.

Each questionnaire had been given a code number in the top right-hand corner to indicate the school and the code of the questionnaire, e.g. 1-001, 1-002, etc. The collected questionnaires were put in the correct order according to the code number on the cover page, with the smaller number on top.

a) Closed questions:

For questions 1,2,3,4,6,9 and 10 (see Appendix I), the number of possible responses was limited and predictable, so the responses had been pre-coded. For example, "1" stood for male and "2" stood for female in question 1, about the respondent's gender. "1" stood for web browsing, "2" stood for simulation, "3" stood for spreadsheets, etc. in question 10, which was about the teachers' use of computer applications in their lessons.

b) Computer attitude scale:

For question 5, the computer attitude scale, the responses were converted into marks: five marks for strongly agree, four for "agree", three for neutral, two for "disagree" and one for "strongly disagree" for positively worded statements. But for negatively worded statements, the mark allocation was the other way round: one mark for

"strongly agree", two for "agree", three for "neutral", so on and so forth. The marks for the questions in each subscale were summed up and entered into the spreadsheets as raw data.

c) Open questions:

Questions 7 and 8 were open-ended questions. Coding started after the questionnaires were returned. The responses were browsed and main features were written down on a large sheet of paper. Some twenty features were identified and they were further reduced into smaller number of categories, e.g. "more effective and motivating lessons", "more efficient management of the teaching materials', "the use of multimedia materials was facilitated", etc. Each of these main categories was ascribed a numeric figure to facilitate data inputting. The responses of these questions were converted into numeric figures.

Inputting of data into the computer began when the first batch of questionnaires was collected. Next, the data were checked carefully to avoid mistakes in data entry.

3.2.4 **Analyses** SPSS Version 7.5 was used to analyse the data.

Area of study	Gender and computer attitudes	
Analytic method	Mean Independent t-test (two-tailed)	The mean attitude scores (numerical data) of two unrelated/ independent samples (male and female teachers) were compared
Hypotheses	Null hypothesis $H_{(0)}$	There is no relationship between the gender of the secondary school teachers in Hong Kong and their scores in computer attitudes.
	Research hypothesis $H_{(R)}$	There is a significant relationship between the age of the secondary school teachers in Hong Kong and their scores in computer attitudes.
Area of study	Age and computer attitudes	
Analytic method	Mean One way analysis of variance	The mean attitude scores (numerical data) of more than two independent samples (age groups) were compared, so ANOVA was used instead of the t-test.
Hypotheses	Null hypothesis $H_{(0)}$	There is no relationship between the age of the secondary school teachers in Hong Kong and their scores in computer attitudes.
	Research hypothesis $H_{(R)}$	There is a significant relationship between the age of the secondary school teachers in Hong Kong and their scores in computer attitudes.
Area of study	Subject category taught and computer attitudes	
Analytic method	Mean Two way analysis of variance	Two way analysis of variance was used to see if there was an interaction between the two factors, gender and subject taught. Without an interaction of the gender factor, the mean attitude scores of teachers of different subject categories were compared.
Hypotheses	Null hypothesis $H_{(0)}$	There is no relationship between the main subject category taught by the secondary school teachers in Hong Kong and their scores in computer attitudes.

	Research hypothesis $H_{(R)}$	There is a significant relationship between the main subject category taught by the secondary school teachers in Hong Kong and their scores in computer attitudes.
Area of study	Gender and frequency of use of IT	
Analytic Method	Cross tabulation Pearson's chi-square test	The expected and observed counts of the two genders were compared, so the chi-square was used.
Hypotheses	Null hypothesis $H_{(0)}$	There is no relationship between the gender of the secondary school teachers in Hong Kong and their frequency of use of IT
	Research hypothesis $H_{(R)}$	There is a significant relationship between the gender of the secondary school teachers in Hong Kong and their frequency of use of IT.
Area of study	Age and frequency of use of IT	
Analytic Method	Cross tabulation Pearson's chi-square test	The expected and observed counts of different age groups were compared, so the chi-square was used.
Hypotheses	Null hypothesis $H_{(0)}$	There is no relationship between the age of the secondary school teachers in Hong Kong and their frequency of use of IT.
	Research hypothesis $H_{(R)}$	There is a significant relationship between the age of the secondary school teachers in Hong Kong and their frequency of use of IT.
Area of study	Subject category taught and frequency of use of IT	
Analytic Method	Cross tabulation Pearson's chi-square test	The expected and observed counts of various subject categories were compared, so the chi-square was used.
Hypotheses	Null hypothesis $H_{(0)}$	There is no relationship between the main subject category taught by the secondary school teachers in Hong Kong and their frequency of use.
	Research hypothesis $H_{(R)}$	There is a significant relationship between the main subject category taught by the secondary school teachers in Hong Kong and their frequency of use of IT.
Area of study	Computer attitudes and frequency of use	
Analytic	Spearman's rho correlation test	The association between computer attitude scores (numerical data) and the frequency of using IT (ordinal data) was

Method		measured.
Hypotheses	Null hypothesis $H_{(0)}$	There is no relationship between computer attitudes and the frequency of using IT
	Research hypothesis $H_{(R)}$	There is a significant relationship between computer attitudes and the frequency of using IT
Area of study	Teachers' major problems in using IT	
Analytic Method	Frequency tables	The number of respondents selecting each response as the first major problem was displayed in frequency tables.
Area of study	Benefits of using IT	
Analytic Method	Frequency table	The number of people choosing each code number of the benefits of using IT was displayed in a frequency table.
Area of study	Changes in the role of the teacher and that of the student	
Analytic Method	Frequency table	The number of people choosing each code number of the changes in the role was displayed in a frequency table.
Area of study	Use of applications	
Analytic Method	Frequency table	The number of people choosing each code number of the applications used was displayed in a frequency table.

3.3 Triangulation

Denzin (1978:291) defines triangulation as "the combination of methodologies in the study of the same phenomenon." Triangular techniques in the social sciences attempt to map out, or explain more fully, "the richness and complexity of human behaviour by studying it from more than one standpoint and, in so doing, by making use of both quantitative and qualitative data"(Cohen and Manion, 1995:223).

In my study, both quantitative and qualitative approaches were used for triangulation. The purpose of using the multimethod approach was two-fold. First it was to cross validate the data generated to ensure that they were not simply artefacts of one specific method of collection (Campbell & Fiske, 1959; Lin, 1976). Thus questions in the survey study concerning opinions about the benefits of using IT, how IT changes the role of the teachers and the students, the difficulties of using IT and the integration of IT in the subject were further explored using the interview method.

Second, methodological triangulation (Denzin, 1970) was intended to capture a "more complete, holistic, and contextual portrayal of the unit(s) under study" (Jick, 1983:138). The qualitative method allows for the illumination of contextual elements and better elicitation of data, which are not plausible with the quantitative method. Thus, in the present study, the interview method was employed to probe a few further issues including views of the drawbacks of using the technology in teaching, opinions of the IT policy, etc. It was hoped that our understanding of the issue could be enriched for "...the use of multiple measures may also uncover some unique variance which otherwise may have been neglected by single methods" (Jick, 1983:138).

3.4 Qualitative Research

3.4.1 Interview Schedule

As mentioned above, some of the issues included in the questionnaire were further explored in the interview schedule for the purpose of cross validation and elicitation of more contextual data. These issues were: teachers' perception of the advantages of using IT, their perceived changes in the role of the teachers and that of the students with the use of IT, and the difficulties encountered. Besides, a few practical issues related to the use of IT were added to the interview schedule to obtain a more comprehensive understanding of the use of the computer. These included the teachers' reasons for using IT, their perceived drawbacks of the technology, matters concerning their actual integration of the computer in the lesson and their general views of the IT policy in Hong Kong. The interview method was used for it indeed yielded more enriching and stimulating contextual data crucial to the understanding of these issues.

The interview started with a brief introduction of the purpose of the study, an assurance of the confidentiality of the data and a request for permission to take notes and record the interview process. Some background information about the respondent: the subject(s) he/she teaches was then sought. The body of the interview schedule was divided into six parts. The content of each part is as follows:

- the reasons for the respondent using IT and the merits of using the technology from his/her experience.
- the difficulties, if any, with using the computer in teaching, whether the difficulties are subject-related and ways to overcome them.
- the perceived changes in the role of the student and the teacher when IT is used and the teacher's feeling about it.

- the respondents' view on the shortcomings of the use of IT.
- the use of IT in relation to the subject(s) the respondent teaches and suggestions of how it can be more effectively used.
- a general question on the respondent's overall view on the IT policy of the SAR government.

(see Appendix II for the interview schedule)

3.4.2 Participants

Eight teachers were interviewed individually. They were chosen by the convenience sampling method. Attention was paid to ensure that the respondents were fairly frequent users of IT so that they would be able to share more readily their experience and their viewpoints of using IT. Four female teachers and four male teachers were chosen and the subjects they taught spread across the four main subject categories in the study. Some of the interviewees also answered the questionnaires and some did not.

3.4.3 Instruments

A clipboard was used for making notes and a digital voice recorder (JVC:DR-W900) was used for recording the interview.

3.4.4 Data Analysis

Each interview lasted about thirty to forty minutes. During the course of the interview, note-taking was done together with the recording. The interviews were conducted in Cantonese, the mother tongue of both the interviewer and the interviewees. Notes were taken in English on the note sheets to facilitate analysis of data. Shortly after each interview, usually within a few days, the scripts were tidied

up with the aid of the recording, to make sure that no important information went missing in the note-taking. Basically every utterance was recorded on the paper except that the utterances were translated into English.

The scripts were broken up, question by question to facilitate analysis. Each script and each question was gone through and the similarities and dissimilarities were noted down. Common themes were identified and categories were devised. The data were coded and put into matrices for display.

3.4.5 Coding

For questions asked in the questionnaire, I tried to use the categories I used for analysing the survey data so that the subsequent comparison between the two sets of data was easier.

a) Advantages of using IT:

I stuck to some categories I used in the survey data: "students more active/ interactive", "abundant authentic materials from the Net", "more motivating and effective teaching", "the use of multimedia materials", "effective use of teaching materials". I also identified two more categories arising from the interview data: "more self-access work" and "resolving constraints of the classroom".

b) Difficulties of using IT:

Several categories were identified from the interview data: "equipment problems", "reliability of the computer", "lack of IT skills", "lack of time and resources". Some of the categories did overlap with those in the survey data.

c) Perceived changes in the role of the students and that of the teachers:

Basically there were two categories: "there was change" and "there was no change or not much change".

For questions which were only included in the interview schedule, the common features in the data were identified.

d) Reasons for using IT

The responses rendered by the respondents to this question were in fact "the advantages of using IT", so this question was merged with that on the advantages of using IT

e) Drawbacks of using the computer:

The following categories were worked out: "should not be made mandatory, "physical effects", " adverse effects on students' learning", "breakdown of equipment", "lack of flexibility and "effects on teaching progress".

f) Integration of the technology in the subject:

The interview also attempted to explore how the teachers actually used the technology in their teaching. The categories included "types of applications", "the amount of resources available", "subject-related difficulties", "successful examples of integration" and "suggestions on better integration".

g) IT Policy in Hong Kong

Four aspects were identified from the views arising from the interviewees' responses: "resources available", "IT knowledge and training", "the role of IT in education" and "the future trend of IT in teaching".

3.5 Chapter Summary

In the first part of the present study, a questionnaire was administered through the convenience sampling method to conduct a survey of secondary school teachers' computer attitudes and computer use in teaching A total of 229 completed questionnaires were received; 53% completed by female secondary teachers and 47%, by male secondary teachers. The main subjects taught by the respondents could be subsumed under four chief categories ---languages, social sciences, sciences and cultural subjects. The 30-item Computer Attitude Scale, developed by Loyd and Gressard, was included in the questionnaire to measure the computer anxiety, confidence and liking of the respondents. The data were entered into the SPSS spreadsheets for analysis.

Triangulation of the survey data was carried out to yield a more complete, holistic and contextual portrayal of the issue through an interview study. The interview schedule included questions concerning teachers' perceptions of the advantages, difficulties and drawbacks of using information technology. The process of integrating IT into their subjects and their views about the IT Policy implemented by the government were also probed. Eight fairly frequent computer teacher users were interviewed. The process was tape-recorded and notes were taken. Common themes and categories were identified and the data were coded, summarised, and displayed in matrices.

Chapter 4 Data Analysis and Findings

4.1 Introduction

This chapter presents findings of both the survey study and the interview study. The findings of the survey study explore the following: first, the relationship between computer attitudes and gender, age and subject taught respectively; second, the relationship between the frequency of use of IT and gender, age and subject taught respectively; third, the association between the frequency of use of IT and computer attitudes; fourth, the relationship between school factors and computer attitudes and the frequency of use of IT; fifth, the teachers' perceptions about the biggest problem of using IT, the benefits of using IT and the change in the role of the teacher and of the student with the innovation and sixth, the pattern of use of computer applications.

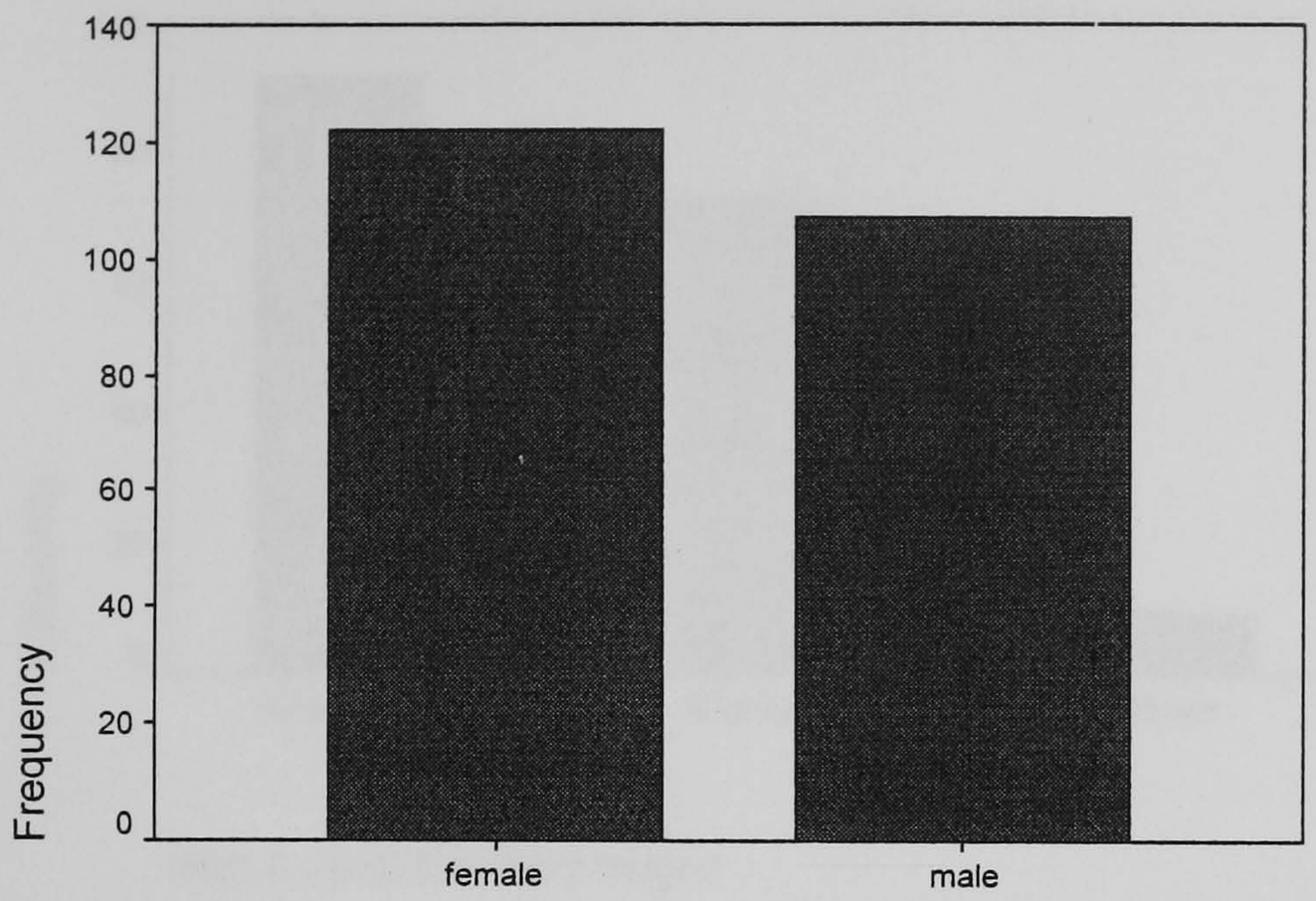
Finally, analyses of the interview study are summed up in matrices. They display the teachers' beliefs about the advantages of instructional use of IT, the impediments to integration, the potential drawbacks and the change in the role of the teacher and the student. Findings about the way teachers integrate the technology into their subject and their opinions about the IT Policy of the Hong Kong government are also presented.

4.2 Survey Findings and Analysis

305 questionnaires were sent out to thirteen secondary schools and 229 completed questionnaires were returned which is a return rate of 75%. One respondent has missed out on one page. About ten completed questionnaires from a particular school went missing in the course of postal delivery.

4.2.1 Demographic Data of the Respondents

Figure 4.1 Bar chart of the gender of teachers



The demographic data of the respondents are shown in Figures 4.1, 4.2 and 4.3. As shown in Figure 4.1, the proportions of both genders were about the same; 52.6% of the respondents were female while 47.4% were male. Figure4.2 displays the five age groups of the respondents while Figure 4.3 shows the distribution of teachers across five categories of subjects they mainly taught.

Figure 4.2 Bar chart of the age groups of teachers

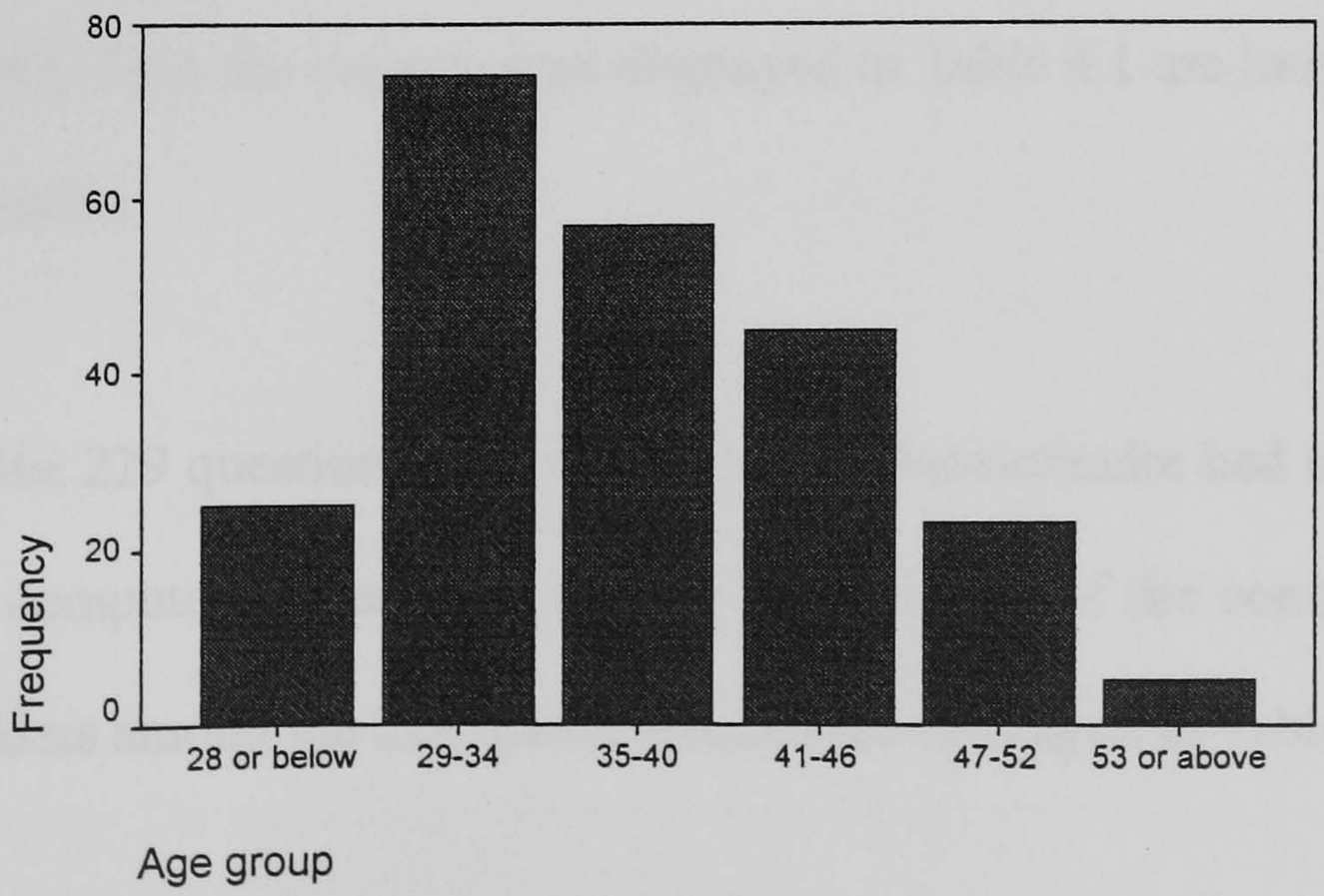
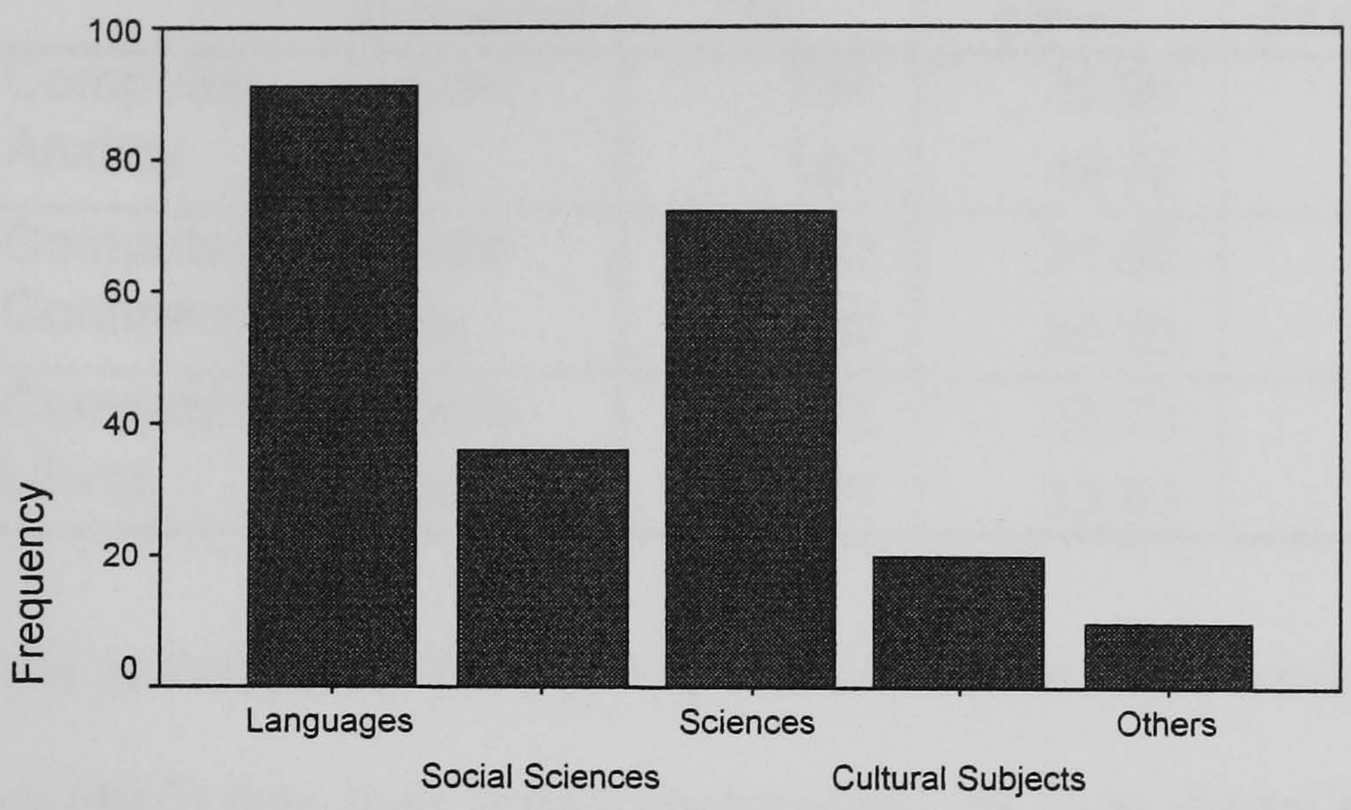


Figure 4.3 Bar chart of the main subject categories taught by teachers



4.2.2 Computer Attitudes

A. Computer Attitudes and Gender

As mentioned in the methodology section, respondents had to report how far they agreed with each of the statements in the computer attitude scale. Each of the three subscales is represented by ten statements. The items were arranged for scoring on a five-point Likert scale, ranging from "strongly agree", through "agree", "neutral" and "disagree" to "strongly disagree". The highest score for each item is five marks and the lowest score is one mark. Hence, the maximum score for each sub-scale is fifty marks. Thus the mean scores displayed in Table 4.1 are interpreted in terms of points or marks.

Of the 229 questionnaires returned, one questionnaire had missing information about the computer scores. The average mean scores of the computer attitudes of the two genders among the 228 questionnaires are displayed in Table 4.1.

Table 4.1 Mean computer attitude scores of female and male teachers

	Gender of teacher	N	Mean	Std. Deviation	Std. Error Mean
Computer Anxiety	female	121	35.96	6.61	.60
	male	107	39.75	6.25	.60
Computer Confidence	female	121	31.90	6.64	.60
	male	107	35.53	7.60	.73
Computer Liking	female	121	30.73	5.67	.52
	male	107	33.83	6.18	.60

As far as computer anxiety was concerned, the male teachers had a higher median score (40.0) than their female counterparts (36.0) as shown in Figure 4.4. The former group also displayed a slightly smaller mean spread in the scores than the latter. The lowest score was 19 (female) and the highest score was 50 (male). The datasets were basically symmetrical.

Figure 4.4 Box-plot of Computer Anxiety by Gender

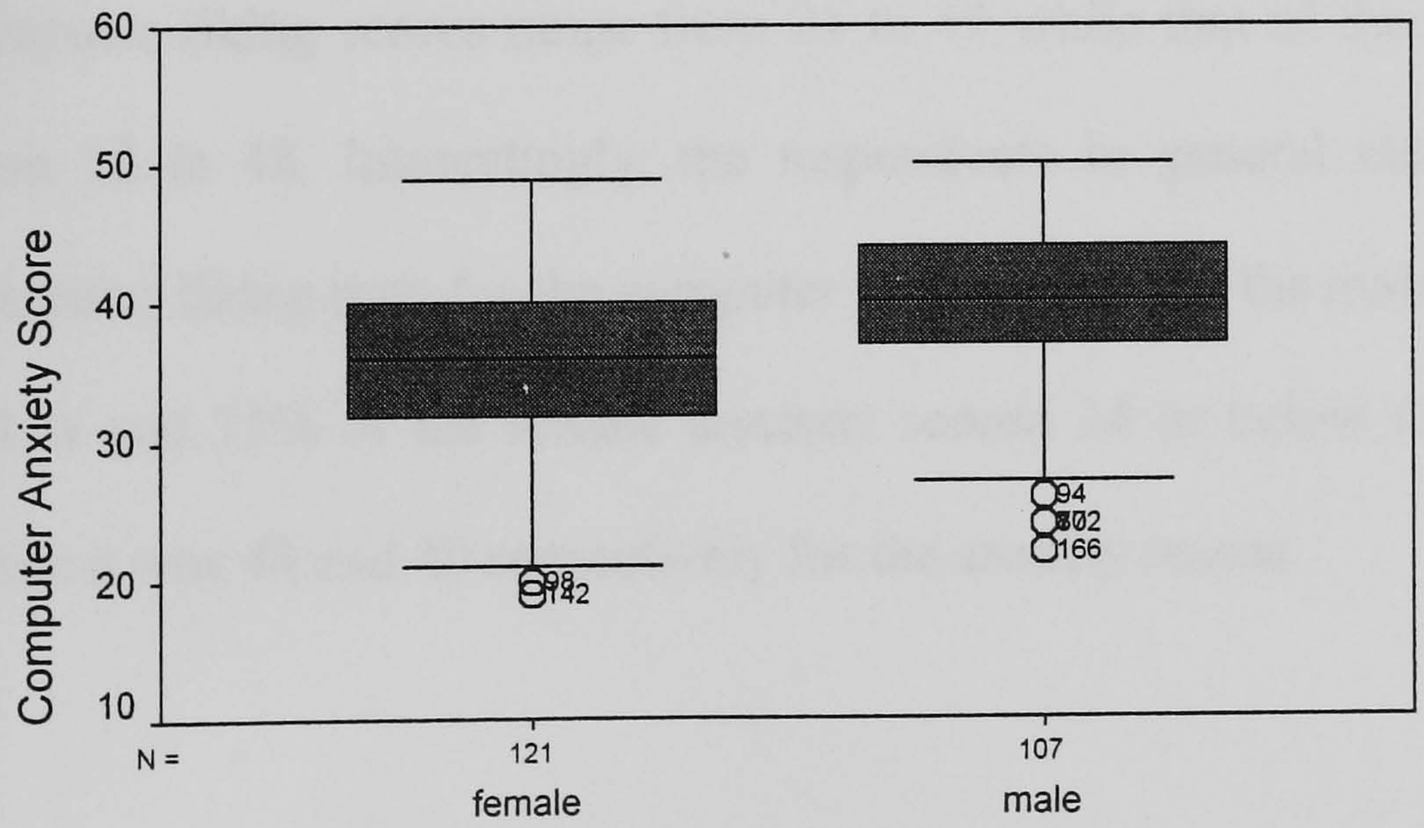
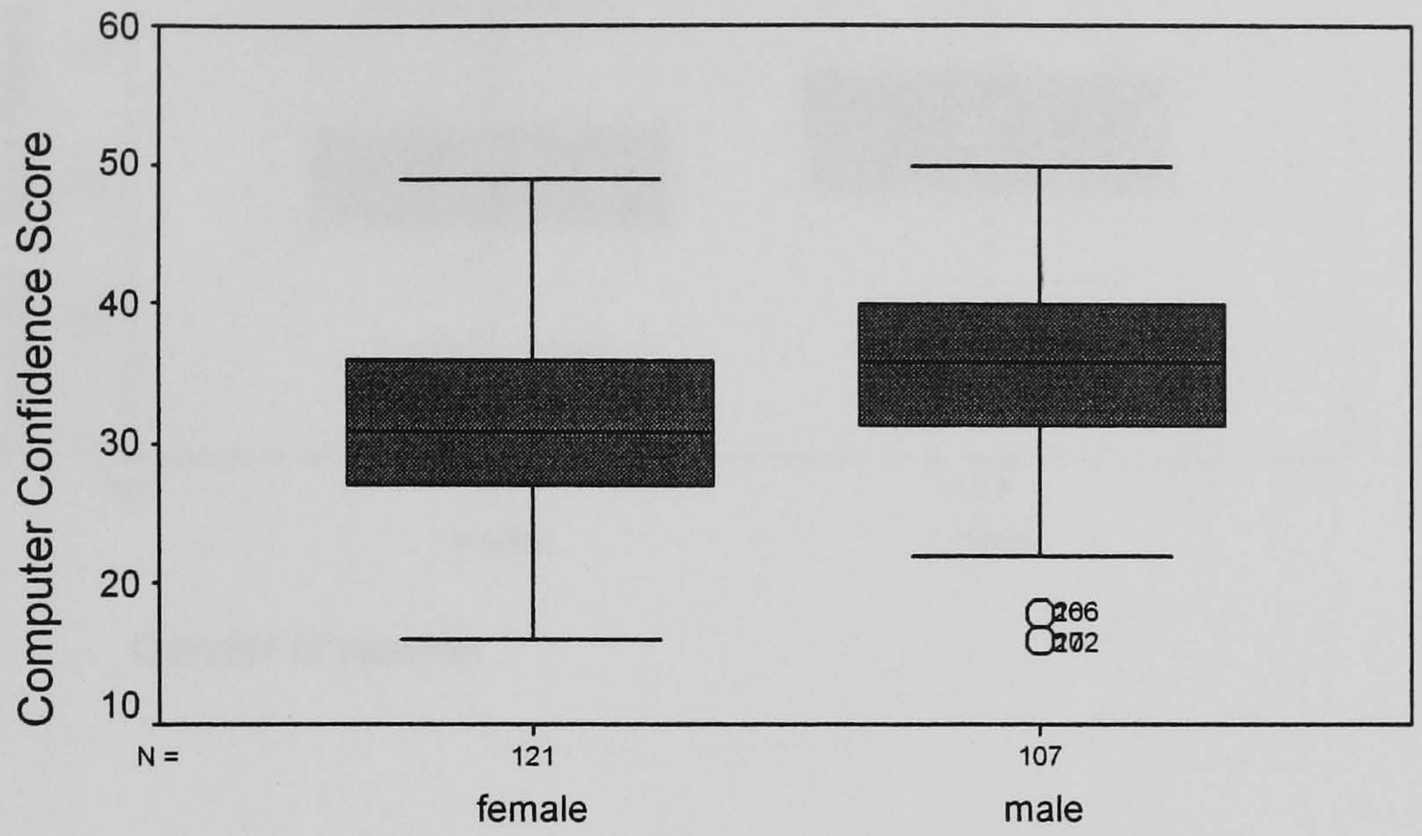


Figure 4.5 is a box-plot showing the computer confidence score and the gender of the teachers. The median confidence score of the male teachers was 5 points higher than that of the female teachers (36 vs 31) while the inter-quartile range was the same in both cases. Both the male and female teachers had the same lowest score (16) and the

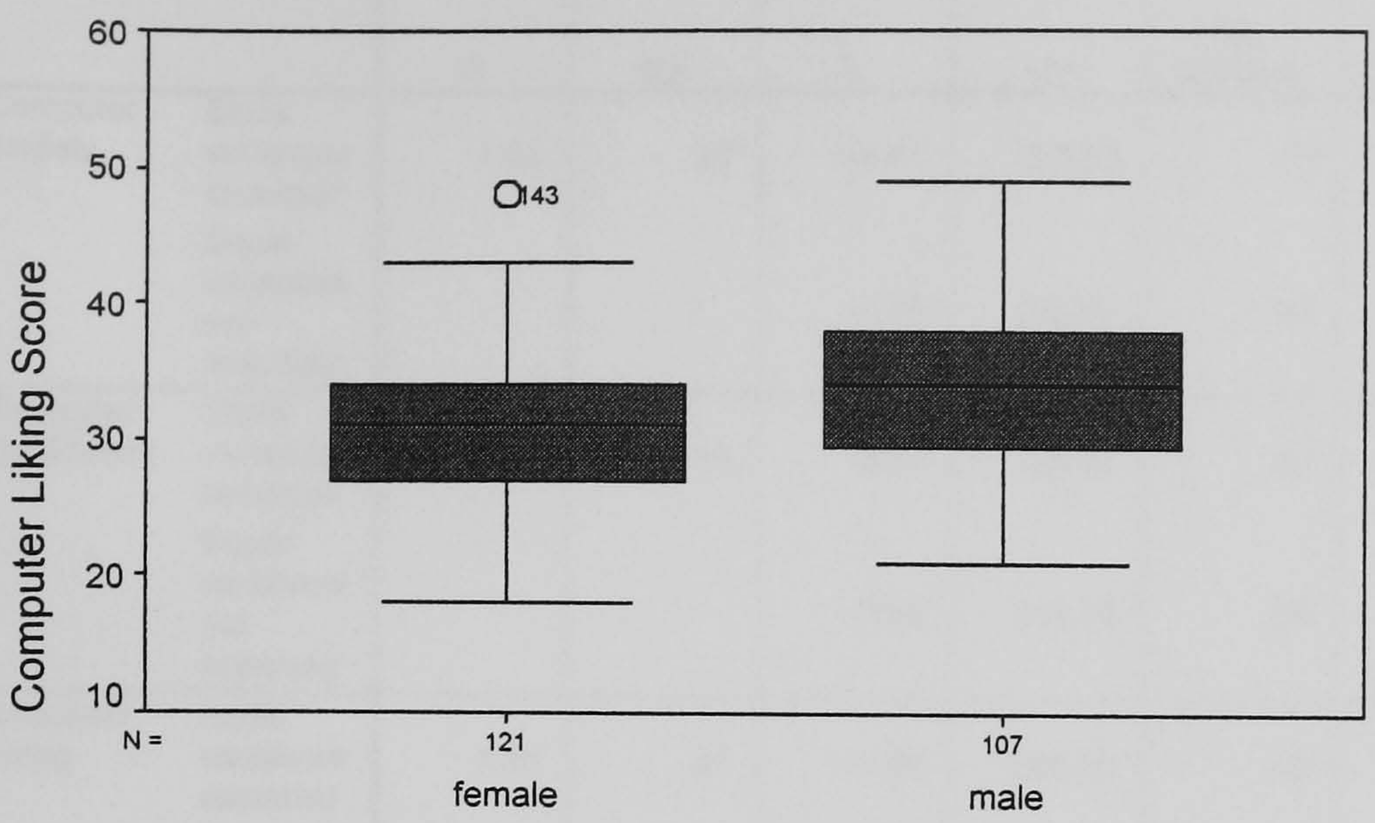
highest confidence scores of both genders were about the same, 50 and 49 for the male and the female respectively.

Figure 4.5 Box-plot of Computer Confidence by Gender



Concerning the computer liking sub-scale, Figure 4.6 shows the smallest median difference between the two genders: 34(male) vs 31(female). The male teachers' computer liking scores range from 21 to 49 while that of the female teachers range from 18 to 48. Interestingly, the respondents in general clearly scored lower for computer liking than for the computer anxiety. 75% of the male teachers scored 38 or below and 75% of the female teachers scored 34 or below for the computer liking while it was 44 and 40 respectively for the anxiety scores.

Figure 4.6 Box-plot of Computer Liking by Gender



An attempt was made to investigate the relationship between gender and computer attitudes. The null hypothesis $H_{(0)}1$ was there is no relationship between the gender of the secondary school teachers in Hong Kong and their scores in computer attitudes. The research hypothesis $H_{(R)}1$ was there is a significant difference between the mean computer attitude score of the male secondary school teachers in Hong Kong and that of their female counterparts.

Table 4.2 Independent Samples Test of computer attitudes by gender

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Mean	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Computer Anxiety	Equal variances assumed	1.30	.25	-4.43	226.00	.00	-3.79	.86	-5.47	-2.10
	Equal variances not assumed			-4.45	224.97	.00	-3.79	.85	-5.47	-2.11
Computer Confidence	Equal variances assumed	1.12	.29	-3.85	226.00	.00	-3.63	.94	-5.49	-1.77
	Equal variances not assumed			-3.82	212.15	.00	-3.63	.95	-5.51	-1.76
Computer Liking	Equal variances assumed	1.08	.30	-3.96	226.00	.00	-3.10	.78	-4.65	-1.56
	Equal variances not assumed			-3.93	216.46	.00	-3.10	.79	-4.66	-1.55

A significance level of .05 was used. Analysis of the data in Table 4.1 using the independent t test for equal variances indicated that the computer attitude scores in terms of the three dimensions; computer anxiety, computer confidence and computer liking of the male teachers were significantly higher than that of the female teachers. According to Table 4.2, male teachers were significantly less anxious, $t(226) = -4.43$, $p = .00$ (two-tailed test), more confident, $t(226) = -3.85$, $p = .00$ (two-tailed test) and had more liking, $t(226) = -3.96$, $p = .00$ (two-tailed test) than the female teachers in the use of the computer.

According to the findings, the null hypothesis that there is no relationship between the gender and the computer attitudes was rejected. There is a significant relationship between gender and computer attitudes.

B. Computer Attitudes and Age

The respondents were divided into five age groups and the mean computer scores of

each age group are illustrated in Table 4.3.

Table 4.3 Mean Computer Attitude Scores of different Age Groups

age		Computer Anxiety	Computer Confidence	Computer Liking
<28	Mean	38.44	33.36	32.00
	N	25	25	25
	Std. Deviation	6.31	6.23	4.49
29-34	Mean	38.12	34.92	32.68
	N	74	74	74
	Std. Deviation	6.26	7.24	5.65
35-40	Mean	38.37	34.40	32.81
	N	57	57	57
	Std. Deviation	6.73	7.45	6.60
41-46	Mean	37.93	32.43	30.91
	N	44	44	44
	Std. Deviation	7.40	8.26	7.33
47-52	Mean	35.30	31.13	32.43
	N	23	23	23
	Std. Deviation	6.50	5.32	5.32
>53	Mean	30.80	28.00	28.80
	N	5	5	5
	Std. Deviation	6.06	7.21	4.97
Total	Mean	37.74	33.61	32.18
	N	228	228	228
	Std. Deviation	6.70	7.32	6.10

The null hypothesis $H_{(0)}2$ was that there is no significant difference among the computer attitude scores of teachers of different age groups. The research hypothesis $H_{(R)}2$ was that there are significant differences.

A significance level of 0.05 was used. The data from Table 4.3 were analysed using the one-way analysis of variance (ANOVA) for independent samples, with age as the independent variable. As shown in Table 4, the analysis for computer anxiety, $F(4, 223) = 1.93$, $p = .11$; for computer confidence, $F(4, 223) = 2.31$, $p = .06$ and for computer liking, $F(4, 223) = .78$, $p = .54$ was not significant, indicating that the

computer scores were equivalent across all age groups. Thus the null hypothesis that there is no relationship between age and computer attitudes was not rejected.

In short, there is not a significant relationship between the age of secondary school teachers and their computer attitudes.

Table 4.4 Test of variance by computer attitudes and age

			Sum of Squares	df	Mean Square	F	Sig.
computer anxiety * Age group	Between	(Combined)	341.09	4	85.27	1.93	.11
	Within Groups		9863.12	223	44.23		
	Total		10204.21	227			
computer confidence * Age group	Between	(Combined)	483.83	4	120.96	2.31	.06
	Within Groups		11674.65	223	52.35		
	Total		12158.47	227			
Computer Liking * Age group	Between	(Combined)	116.82	4	29.20	.78	.54
	Within Groups		8333.44	223	37.37		
	Total		8450.26	227			

C. Computer Attitudes and Main Subjects taught

According to Table 4.5, the mean computer attitude scores gained by science teachers were higher than those gained by the other subject teachers. For science teachers, *M* for computer anxiety = 40.54, *SD* = 6.20; *M* for computer confidence = 36.76, *SD* = 7.44; and *M* for computer liking = 33.81, *SD* = 5.62. For language teachers, *M* for computer anxiety = 36.31, *SD* = 6.91; *M* for computer confidence = 31.57, *SD* = 6.85; and *M* for computer liking = 31.02, *SD* = 6.45.

Science teachers had the highest scores even when the same sex comparison was made. In other words, both female and male science teachers scored the highest marks in computer attitudes when they were compared with teachers of the same sex teaching other subject categories.

Table 4.5 Computer Attitudes Means of Main Subject Category taught and Gender subgroups.

Main subject	Gender of teacher		Computer anxiety	Computer confidence	Computer liking
Languages	female	Mean	35.22	30.89	30.12
		N	65	65	65
		Std. Deviation	7.09	6.93	6.21
	male	Mean	39.16	33.32	33.36
		N	25	25	25
		Std. Deviation	5.60	6.44	6.61
	Total	Mean	36.31	31.57	31.02
		N	90	90	90
		Std. Deviation	6.91	6.85	6.45
Social Sciences	female	Mean	36.14	32.10	30.95
		N	21	21	21
		Std. Deviation	6.74	6.02	5.36
	male	Mean	34.67	30.60	31.00
		N	15	15	15
		Std. Deviation	7.06	8.45	5.41
	Total	Mean	35.53	31.47	30.97
		N	36	36	36
		Std. Deviation	6.81	7.06	5.30
Sciences	female	Mean	38.37	34.47	32.63
		N	19	19	19
		Std. Deviation	6.42	6.98	4.36
	male	Mean	41.32	37.58	34.23
		N	53	53	53
		Std. Deviation	5.98	7.50	5.99
	Total	Mean	40.54	36.76	33.81
		N	72	72	72
		Std. Deviation	6.20	7.44	5.62
Cultural Subjects	female	Mean	36.44	32.89	29.56
		N	9	9	9
		Std. Deviation	3.17	5.62	3.50
	male	Mean	40.00	36.64	36.09
		N	11	11	11
		Std. Deviation	4.65	4.99	4.99
	Total	Mean	38.40	34.95	33.15
		N	20	20	20
		Std. Deviation	4.35	5.48	5.42
Others	female	Mean	35.14	32.43	32.00
		N	7	7	7
		Std. Deviation	4.95	5.26	6.51
	male	Mean	41.33	38.33	36.67
		N	3	3	3
		Std. Deviation	6.43	10.02	11.50
	Total	Mean	37.00	34.20	33.40
		N	10.00	10.00	10.00
		Std. Deviation	5.87	6.99	7.92
Total	female	Mean	35.96	31.90	30.73
		N	121.00	121.00	121.00
		Std. Deviation	6.61	6.64	5.67
	male	Mean	39.75	35.53	33.83
		N	107	107	107
		Std. Deviation	6.25	7.60	6.18
	Total	Mean	37.74	33.61	32.18
		N	228	228	228
		Std. Deviation	6.70	7.32	6.10

The relationship between computer attitudes and the main subjects taught by the teachers was investigated. The null hypothesis $H_{(0)}3$ was that there is no relationship between the main subjects taught and the computer attitudes of the teachers. The research hypothesis $H_{(R)}3$ was that there is a significant relationship between the main subject taught and the computer attitudes.

Before the main subject category was examined as the main independent factor on computer attitudes, a further attempt was made to see if the gender effect would skew the results. A two-way analysis of variance for independent samples was used, with the significance level of .05, to test the gender by main subject category interaction. The null hypothesis was there is no interaction between the two variables, gender and the main subject category taught.

As shown in Tables 4.6, 4.7 and 4.8, the analysis for computer anxiety, $F(4,223) = 1.32$, $p = .26$; for computer confidence, $F(4, 223) = .90$, $p = .46$ and for computer liking, $F(4, 223) = 1.18$, $p = .32$ is not statistically significant, so the null hypothesis that there is no interaction between the two variables, gender and the main subject category was retained.

Table 4.6 Two-Way Analysis-of-Variance of Computer Anxiety and Gender and Main Subject Category[a,b]

			Unique Method				
			Sum of Squares	df	Mean Square	F	Sig.
Computer Anxiety	Main Effects	(Combined)	871.76	5	174.35	4.37	.00
		Main subject category taught	466.87	4	116.72	2.92	.02
		Gender of teacher	250.20	1	250.20	6.27	.01
	2-Way Interactions	Main subject category taught * Gender of teacher	210.65	4	52.66	1.32	.26
	Model		1504.25	9	167.14	4.19	.00
	Residual		8699.96	218	39.91		
	Total		10204.21	227	44.95		

a. computer anxiety by Main subject category taught, Gender of teacher

b. All effects entered simultaneously

Table 4.7 Two-Way Analysis-of-Variance of Computer Confidence and Gender and Main Subject Category[a,b]

			Unique Method				
			Sum of Squares	df	Mean Square	F	Sig.
Computer Confidence	Main Effects	(Combined)	1068.41	5	213.68	4.45	.00
		Main subject category taught	721.43	4	180.36	3.76	.01
		Gender of teacher	204.03	1	204.03	4.25	.04
	2-Way Interactions	Main subject category taught * Gender of teacher	172.71	4	43.18	.90	.46
	Model		1699.96	9	188.88	3.94	.00
	Residual		10458.52	218	47.97		
	Total		12158.47	227	53.56		

a. computer confidence by Main subject category taught, Gender of teacher

b. All effects entered simultaneously

Table 4.8 Two-Way Analysis-of-Variance of Computer Liking and Gender and Main Subject Category[a,b]

			Unique Method				
			Sum of Squares	df	Mean Square	F	Sig.
Computer Liking	Main Effects	(Combined)	532.53	5	106.51	3.07	.01
		Main subject category taught	195.24	4	48.81	1.41	.23
		Gender of teacher	281.29	1	281.29	8.10	.00
	2-Way Interactions	Main subject category taught * Gender of teacher	164.06	4	41.02	1.18	.32
	Model		879.03	9	97.67	2.81	.00
	Residual		7571.23	218	34.73		
	Total		8450.26	227	37.23		

a. Computer Liking by Main subject category taught, Gender of teacher

b. All effects entered simultaneously

With the absence of interaction between gender and the main subject category taught, the main subject category as a main effect on computer attitudes could then be investigated. The research hypothesis, $H_{(R)}3$ that there is a significant relationship between the main subject taught and the computer attitudes was tested.

The main subject category was looked at as the independent factor and the computer attitudes, the dependent variable. A significance level of .05 was used. The ANOVA test analysis for computer anxiety, $F(4,223) = 2.92$, $p = .02$, for computer confidence, $F(4,223) = 3.76$, $p = .01$; was statistically significant and the analysis for computer liking $F(4,223) = 1.41$, $p = .23$, was not significant (Tables4.6, 4.7 and 4.8). The null hypothesis $H_{(0)}3$ that there is no relationship between the main subjects taught and the computer attitudes of the teachers was thus rejected.

In order to find out exactly which subject categories teachers differed from the others,

a Bonferroni test was carried out for multiple comparison (see Appendix III). Analysis of the test, using a significance level of .05, indicated that science teachers differed significantly from language teachers in computer anxiety scores (p = .00), in computer confidence score (p = .00) and in computer liking score (p = .04). Science teachers also differed significantly from social science teachers in computer anxiety (p = .00) and computer confidence, (p = .00) but not in computer liking (p = .22) Taken as a whole, the null hypothesis was rejected.

All in all, there is a significant difference between teachers of different subject categories and the computer attitude scores.

4.2.3 Frequency of Computer Use

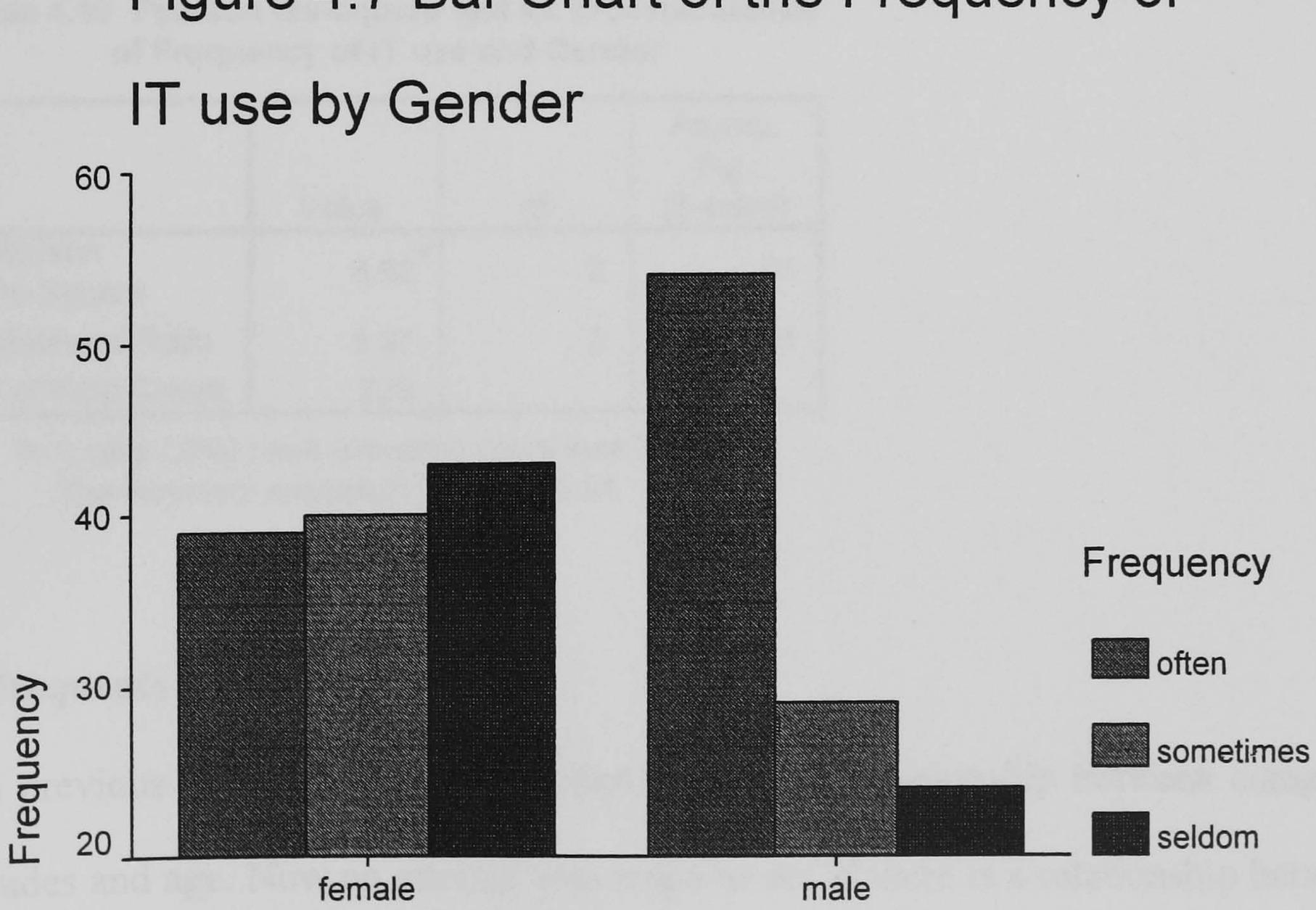
A. Frequency of Use and Gender

Earlier on a relationship was found between the gender of teachers and the computer attitudes. Male teachers scored significantly higher than the female teachers did. Gender was also cross-tabbed with the teachers' actual frequency of use of IT in their teaching to see if the gender difference was also reflected in the actual use. The frequency scales were regrouped into three main categories. The "often" category included those who used IT every day, every two to three days or weekly, the "sometimes" category included those who used IT every two weeks or monthly while the third category was the "seldom" category. As Table 4.9 indicates, in the case of female teachers, the use increases from left to right while in the case of the male teachers, the percentage of use decreases from left to right.

Table 4.9 Crosstabulation of Frequency of IT use and Gender

			Frequency of Use of IT			
			often	sometimes	seldom	Total
Gender of teacher	female	Count	39	40	43	122
		% within Gender of teacher	32.0%	32.8%	35.2%	100.0%
		Residual	-10.5	3.2	7.3	
	male	Count	54	29	24	107
		% within Gender of teacher	50.5%	27.1%	22.4%	100.0%
		Residual	10.5	-3.2	-7.3	
Total		Count	93	69	67	229
		% within Gender of teacher	40.6%	30.1%	29.3%	100.0%

Figure 4.7 Bar Chart of the Frequency of



Based on the data from Table 4.9, a test was run to attest the null hypothesis. $H_{(0)}$ 4,

which stated there is no significant relationship between gender and the frequency of use of IT in teaching, The research hypothesis $H_{(R)}$ 4 was that there is a significant relationship between gender and the frequency of use of IT.

A significance level of 0.05 was used. Analysis of the data displayed in Table 4.10 using chi-square indicated that the frequency of use of IT was significantly associated with gender, χ^2 (2, N =229) =8.62, p = .013. The male teachers tended to use the IT more often than the female teachers. The null hypothesis was thus rejected.

In brief, the findings revealed an association between the gender and the frequency of IT use.

Table 4.10 Pearson chi-square test for crosstabulation of Frequency of IT use and Gender

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.62[a]	2	.01
Likelihood Ratio	8.67	2	.01
N of Valid Cases	229		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 31.31.

B. Frequency of Use and Age

In a previous section, it was found that there is no relationship between computer attitudes and age. Now an attempt was made to see if there is a relationship between the actual frequency of use and age. The null hypothesis $H_{(0)}5$ was that there is no relationship between the frequency of use of IT and age, The research hypothesis $H_{(R)}5$ was that a relationship exists between age and the frequency of use. Thus age groups were cross-tabbed with frequency of use as indicated in Table 4.11.

Table 4.11 Crosstabulation of Frequency of IT use by Age and Gender

Gender of teacher				frequency of use			Total
				often	sometimes	seldom	
female	Age group	34 or below	Count	23	19	17	59
			% within Age group	39.0%	32.2%	28.8%	100.0%
			% within frequency of use	59.0%	47.5%	39.5%	48.4%
		35-40	Count	12	12	6	30
			% within Age group	40.0%	40.0%	20.0%	100.0%
			% within frequency of use	30.8%	30.0%	14.0%	24.6%
		41-46	Count	3	2	12	17
			% within Age group	17.6%	11.8%	70.6%	100.0%
			% within frequency of use	7.7%	5.0%	27.9%	13.9%
		47 or above	Count	1	7	8	16
			% within Age group	6.3%	43.8%	50.0%	100.0%
			% within frequency of use	2.6%	17.5%	18.6%	13.1%
Total			Count	39	40	43	122
			% within Age group	32.0%	32.8%	35.2%	100.0%
			% within frequency of use	100.0%	100.0%	100.0%	100.0%
male	Age group	34 or below	Count	23	11	6	40
			% within Age group	57.5%	27.5%	15.0%	100.0%
			% within frequency of use	42.6%	37.9%	25.0%	37.4%
		35-40	Count	12	6	9	27
			% within Age group	44.4%	22.2%	33.3%	100.0%
			% within frequency of use	22.2%	20.7%	37.5%	25.2%
		41-46	Count	15	9	4	28
			% within Age group	53.6%	32.1%	14.3%	100.0%
			% within frequency of use	27.8%	31.0%	16.7%	26.2%
		47 or above	Count	4	3	5	12
			% within Age group	33.3%	25.0%	41.7%	100.0%
			% within frequency of use	7.4%	10.3%	20.8%	11.2%
Total			Count	54	29	24	107
			% within Age group	50.5%	27.1%	22.4%	100.0%
			% within frequency of use	100.0%	100.0%	100.0%	100.0%

Figure 4.8 Frequency of IT use of different Age Groups of Female Teachers

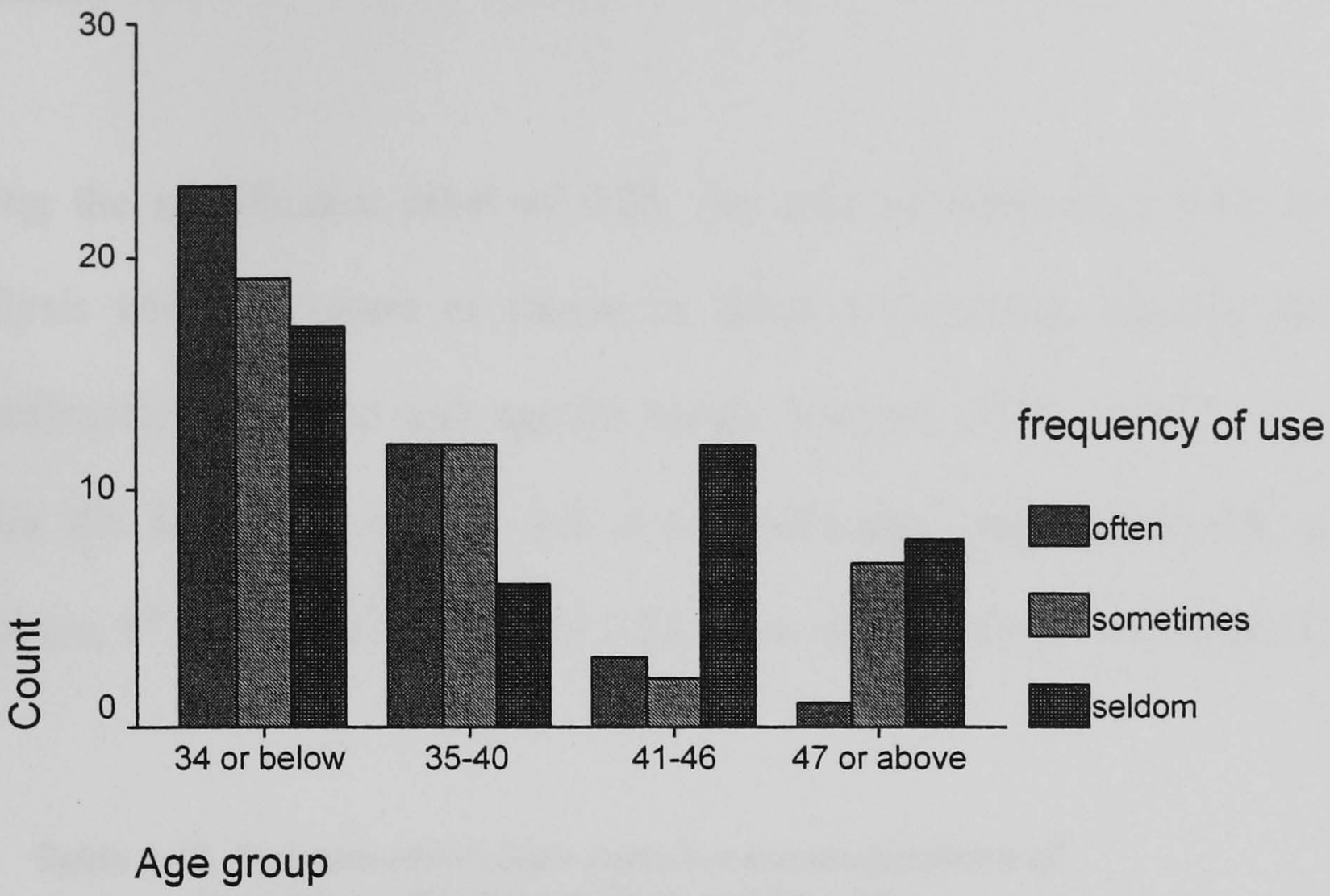
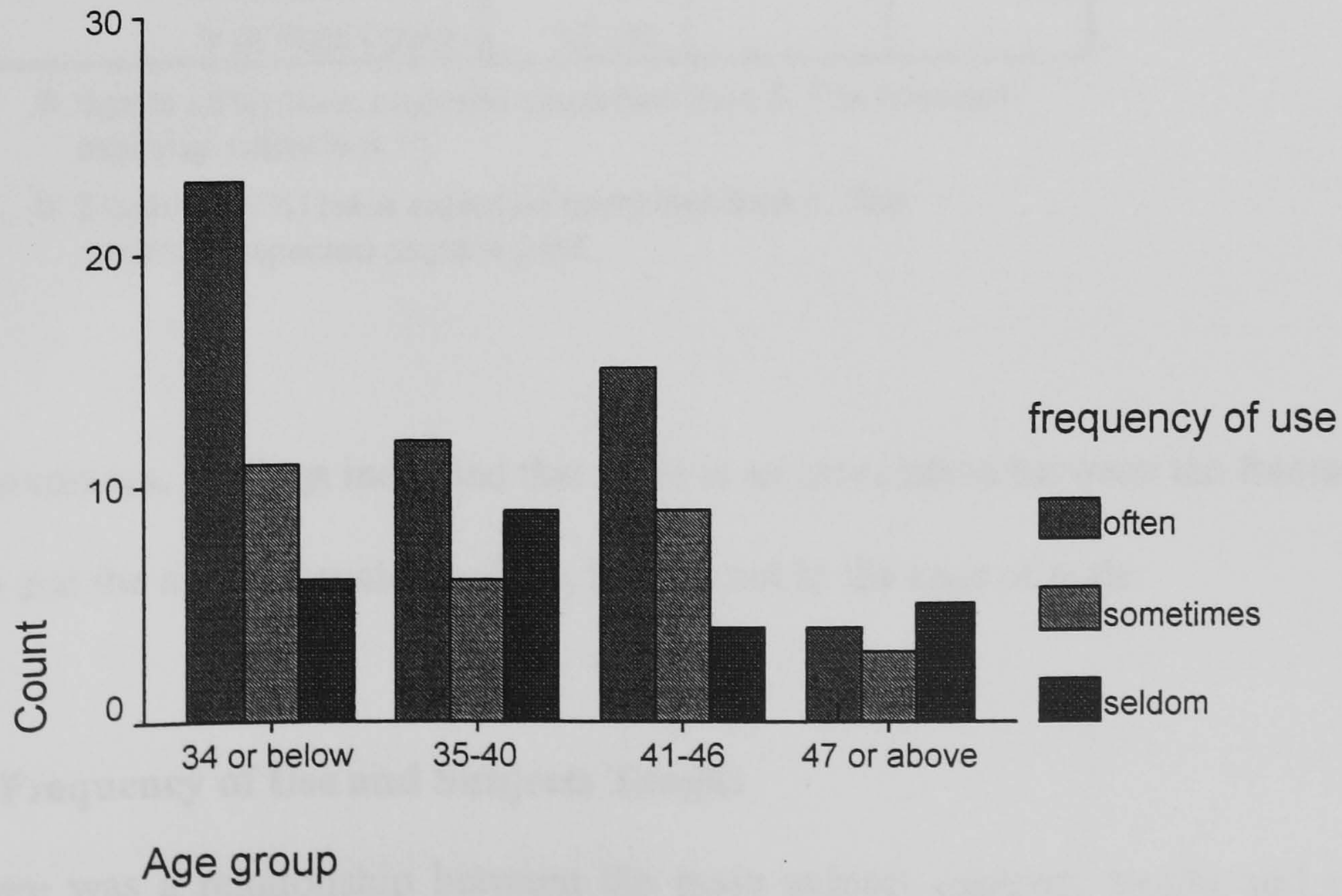


Figure 4.9 Frequency of IT use of different Age Groups of Male Teachers



Figures 4.8 and 4.9 illustrate clearly that the frequency of use of IT decreased with age in the case of female teachers. There is no such a distinctive pattern in the male teachers.

Using the significance level of 0.05, the data in Table 4.11 were analysed. The analysis with chi-square as shown in Table 4.12 reveals that the frequency was significantly associated with age for female teachers, X^2 (6, N =122) = 18.96, p = .00 while the frequency of use was not significantly associated with age for male teachers, X^2 (6, N=107) = 7.08, p= 0.31. Thus the hypothesis was rejected.

Table 4.12 Pearson chi-square tests for crosstabulation of Frequency of IT Use by Age and Gender

Gender of teacher		Value	df	Asymp. Sig. (2-sided)
female	Pearson Chi-Square	18.96[a]	6	.00
	Likelihood Ratio	20.32	6	.00
	N of Valid Cases	122.00		
male	Pearson Chi-Square	7.08[b]	6	.31
	Likelihood Ratio	6.83	6	.34
	N of Valid Cases	107.00		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.11.

b. 2 cells (16.7%) have expected count less than 5. The minimum expected count is 2.69.

In summary, findings indicated that there is an association between the frequency of use and the age of female teachers, though not in the case of male.

C. Frequency of Use and Subjects Taught

There was a relationship between the main subject category taught and computer

attitudes according to the data analysis. What about the main subject category taught and the frequency of use of IT? The null hypothesis $H_{(0)}6$ was established: there is no relationship between the main subject category taught and the frequency of use of IT. The research hypothesis, $H_{(R)}6$ was that a relationship between the two variables exists. A cross-tabulation was conducted with the two variables as shown in Table 4.13.

Table 4.13 Crosstabulation of the Frequency of IT Use and Subject Category taught

			Frequency of the use of IT			
			often	sometimes	seldom	Total
Subject Category	languages	Count	17	32	42	91
		% within main subject category	18.7%	35.2%	46.2%	100.0%
		Residual	-20.0	4.6	15.4	
	social sciences	Count	19	14	3	36
		% within main subject category	52.8%	38.9%	8.3%	100.0%
		Residual	4.4	3.2	-7.5	
	sciences	Count	41	14	17	72
		% within main subject category	56.9%	19.4%	23.6%	100.0%
		Residual	11.8	-7.7	-4.1	
	cultural subjects	Count	8	7	5	20
		% within main subject category	40.0%	35.0%	25.0%	100.0%
		Residual	-.1	1.0	-.9	
	others	Count	8	2	0	10
		% within main subject category	80.0%	20.0%	.0%	100.0%
		Residual	3.9	-1.0	-2.9	
Total		Count	93	69	67	229
		% within main subject category	40.6%	30.1%	29.3%	100.0%

With the significance level at 0.05, the data in Table 4.13 were analysed using chi-square. The findings in Table 4.14 reveal that frequency of use was significantly associated with the main subject category taught, X_2 (8, N = 229) = 43.65, p = .00. Therefore the null hypothesis was rejected.

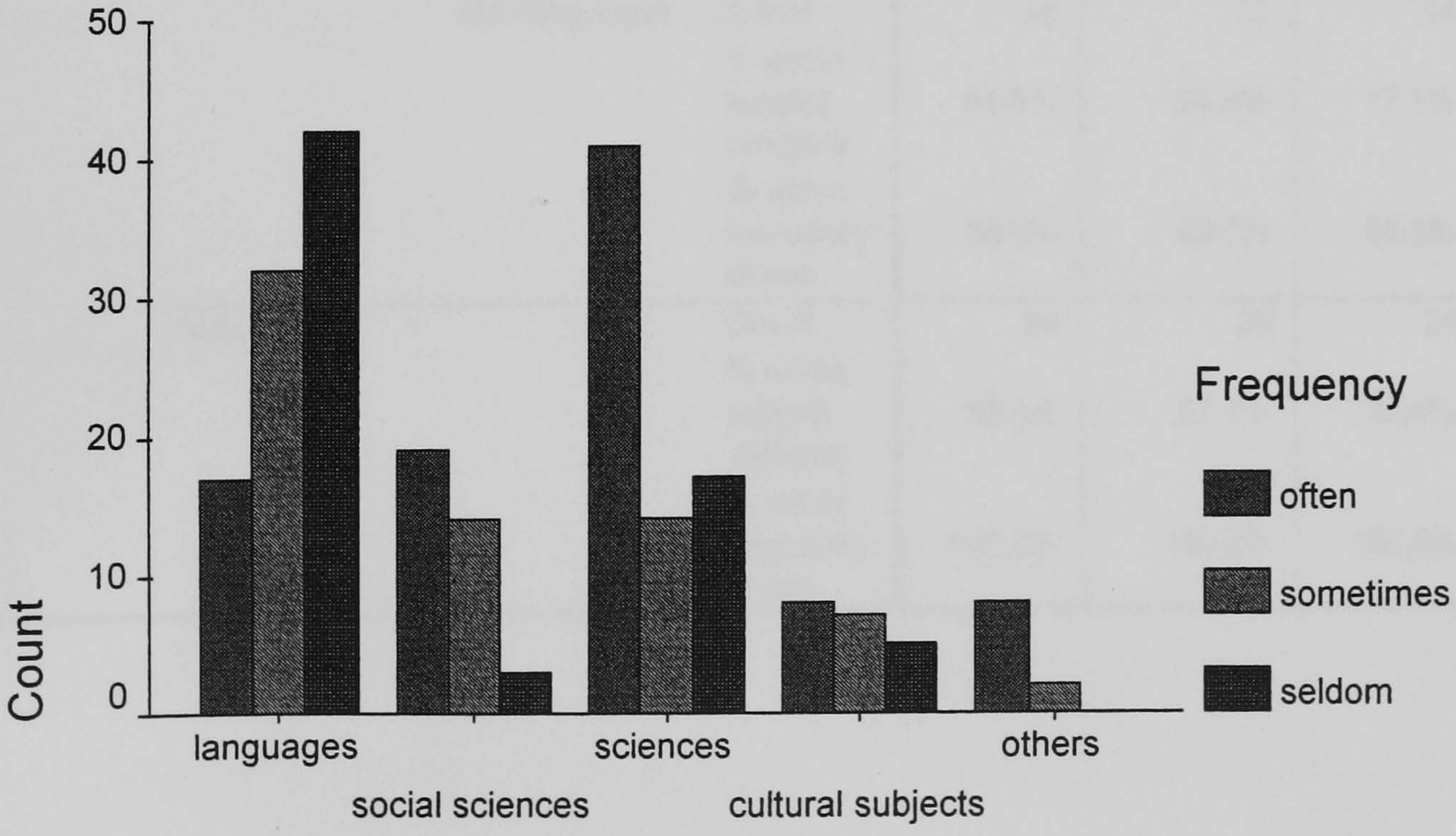
Table 4.14 Pearson chi-square test for crosstabulation of Frequency of IT Use and Suject Category taught

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	43.65[a]	8	.00
Likelihood Ratio	49.00	8	.00
N of Valid Cases	229		

a. 3 cells (20.0%) have expected count less than 5. The minimum expected count is 2.93.

According to Table 4.13 and Fig 4.10, nearly half of the language teachers seldom used IT in their teaching and the percentages descended towards the left-hand column. For teachers teaching other subjects the pattern reversed.

Figure 4.10 Bar chart of the Frequency of IT Use by the Main Subject Category taught



To investigate if the subject difference was owing to the gender effect, the frequency of IT use among male and female teachers was scrutinised separately.

Table 4.15 Crosstabulation of Frequency of IT Use by Language and Non-language Teachers and Gender

Gender of teacher				frequency of use			Total
				often	sometimes	seldom	
female	subject category	languages	Count	11	23	32	66
			% within subject category	16.7%	34.8%	48.5%	100.0%
			% within frequency of use	28.2%	57.5%	74.4%	54.1%
		non-languages	Count	28	17	11	56
			% within subject category	50.0%	30.4%	19.6%	100.0%
			% within frequency of use	71.8%	42.5%	25.6%	45.9%
	Total		Count	39	40	43	122
			% within subject category	32.0%	32.8%	35.2%	100.0%
			% within frequency of use	100.0%	100.0%	100.0%	100.0%
male	subject category	languages	Count	6	9	10	25
			% within subject category	24.0%	36.0%	40.0%	100.0%
			% within frequency of use	11.1%	31.0%	41.7%	23.4%
		non-languages	Count	48	20	14	82
			% within subject category	58.5%	24.4%	17.1%	100.0%
			% within frequency of use	88.9%	69.0%	58.3%	76.6%
	Total		Count	54	29	24	107
			% within subject category	50.5%	27.1%	22.4%	100.0%
			% within frequency of use	100.0%	100.0%	100.0%	100.0%

Table 4.16 Pearson chi-square test of the Frequency of IT Use by Language and Non-language Teachers and Gender

Gender of teacher		Value	df	Asymp. Sig. (2-sided)
female	Pearson Chi-Square	17.87[a]	2	.00
	Likelihood Ratio	18.46	2	.00
male	Pearson Chi-Square	9.97[b]	2	.01
	Likelihood Ratio	10.14	2	.01

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 17.90.

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.61.

Tables 4.15 and 4.16 show that frequency of IT use was significantly associated with the main subject category taught, $X_2(2, N = 229) = 17.87$, $p = .00$ for female teachers and frequency of use was significantly associated with the main subject category taught, $X_2(2, N = 229) = 9.97$, $p = .01$ for male teachers. Thus the subject difference was significant both among male teachers or female teachers.

To conclude there is an association between the main subject category taught by the teachers and the frequency of use of IT.

4.2.4 Frequency of Use and Computer Attitudes

The null hypothesis $H_{(0)}7$ was there is no relationship between the frequency of use of IT and the computer attitudes of teachers. The research hypothesis $H_{(R)}7$ was that there is a relationship between the two. A significance level of 0.01 was used. Analysis of data using Spearman's rho as shown in Table 4.17 indicated that frequency was significantly correlated to computer anxiety, $r_s(228) = -.21$, $p = .00$ (two-tailed test), significantly correlated to computer confidence, $r_s\ (228) = -3.3$, $p = .00$ (two-tailed test) and also significantly correlated to computer liking, $r_s\ (228) =$

-.30, p = .00 (two-tailed test). Computer anxiety was slightly correlated while computer confidence and liking were moderately correlated to the frequency of use. The higher the computer scores, the lower was the ordinal scale, i.e. the higher the frequency.

Table 4.17 Correlations between Computer Attitudes and Frequency of Use of IT

			computer anxiety	computer confidence	Computer Liking	frequency of use
Spearman's rho	Correlation Coefficient	computer anxiety	1.00	.79**	.61**	-.21**
		computer confidence	.79**	1.00	.70**	-.33**
		Computer Liking	.61**	.70**	1.00	-.30**
		frequency of use	-.21**	-.33**	-.30**	1.00
	Sig. (2-tailed)	computer anxiety	.	.00	.00	.00
		computer confidence	.00	.	.00	.00
		Computer Liking	.00	.00	.	.00
		frequency of use	.00	.00	.00	.
	N	computer anxiety	228	228	228	228
		computer confidence	228	228	228	228
		Computer Liking	228	228	228	228
		frequency of use	228	228	228	229

**. Correlation is significant at the .01 level (2-tailed).

4.2.5 Differences among Schools

An attempt was made to gauge the difference of computer attitudes among different schools. The null hypothesis $H_{(0)}8$ established was that there is no difference in the computer attitudes among schools while the research hypothesis $H_{(R)}8$ was that a relationship does exist. The alpha level of 0.05 was used. The ANOVA was conducted on the data for independent samples; with schools as the independent variable and the computer attitudes as the dependent variable. According to Table

4.18, the analysis on computer anxiety and computer liking was statistically significant F (11, 216) = 2.20, p = .02 and F (11, 216) = 2.02, p = .03 while the one on computer confidence was not significant, F (11, 216) = 0.94, p = .50. Therefore the null hypothesis was rejected.

Table 4.18 Test of variance by Computer Attitudes and different Schools

		Sum of Squares	df	Mean Square	F	Sig.
computer anxiety	Between Groups	1030.15	11.00	93.65	2.20	.02
	Within Groups	9174.06	216.00	42.47		
	Total	10204.21	227.00			
computer confidence	Between Groups	555.68	11.00	50.52	.94	.50
	Within Groups	11602.80	216.00	53.72		
	Total	12158.47	227.00			
computer liking	Between Groups	788.21	11.00	71.66	2.02	.03
	Within Groups	7662.05	216.00	35.47		
	Total	8450.26	227.00			

A multiple comparison was conducted to find out where the differences lied. It was found that there was a significant difference between school C and school F(p = .03) for computer anxiety and (p = .04) for computer liking (see Appendix IV).

The data were further analyzed to see if there is a difference in the actual use of the computer. The null hypothesis was established. $H_{(0)}9$ stated that there is no relationship between the frequency of IT use among schools. The research hypothesis $H_{(R)}9$ was there is a relationship between schools and the frequency of use. A cross-tabulation was formed with schools and frequency of IT use. The data are shown in Table 4.19.

Table 4.19 Crosstabuaion of Schools and Frequeny of IT Use

			frequency of use			
			often	sometimes	seldom	Total
Name of school	A	Count	9	7	8	24
		% within Name of school	37.5%	29.2%	33.3%	100.0%
	B	Count	6	5	2	13
		% within Name of school	46.2%	38.5%	15.4%	100.0%
	C	Count	4	3		7
		% within Name of school	57.1%	42.9%		100.0%
	D	Count	6	3	1	10
		% within Name of school	60.0%	30.0%	10.0%	100.0%
	E	Count	4	6	5	15
		% within Name of school	26.7%	40.0%	33.3%	100.0%
	F	Count	9	6	3	18
		% within Name of school	50.0%	33.3%	16.7%	100.0%
	G	Count	10	12	9	31
		% within Name of school	32.3%	38.7%	29.0%	100.0%
	H	Count	6	3	4	13
		% within Name of school	46.2%	23.1%	30.8%	100.0%
	I	Count	2	2	1	5
		% within Name of school	40.0%	40.0%	20.0%	100.0%
	J	Count	6	1	13	20
		% within Name of school	30.0%	5.0%	65.0%	100.0%
	K	Count	6	4	14	24
		% within Name of school	25.0%	16.7%	58.3%	100.0%
	L	Count	25	17	7	49
		% within Name of school	51.0%	34.7%	14.3%	100.0%
Total		Count	93	69	67	229
		% within Name of school	40.6%	30.1%	29.3%	100.0%

Table 4.20 Pearson chi-square for the Crosstabulation of Schools and Freuquency of IT Use

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	39.88[a]	22	.01
Likelihood Ratio	42.25	22	.01
N of Valid Cases	229		

a. 15 cells (41.7%) have expected count less than 5. The minimum expected count is 1.46.

A significance level of 0.05 was used. Analysis of the data in Table 4.19 using chi-square revealed that the frequency of use of IT was significantly associated with schools as shown in Table 4.20, $X_2(22, N= 229) = 39.88$, $p = .01$. Some schools tended to use IT more frequently than the others. Thus the null hypothesis that there is no difference in the frequency of use of IT among different schools was rejected.

Among the 12 schools as shown in Table 4.19, the frequency of use in some schools like School A and School G, was fairly evenly distributed among the teachers. In some schools such as Schools C, D, F and L, half of the teachers or more than that used IT often while some other schools like Schools J and K presented a different picture.

4.2.6 Problems faced by the Teachers

Four major difficulties in integrating IT into teaching were included in the questionnaire: a) “I don’t have time preparing IT for my lessons.”, b)”I don’t know how to integrate IT into the subject I teach”, c) “I don’t have enough training in IT and assistance from school” and d) “I am afraid of making mistakes in the classroom

which I cannot handle". Frequency tables were tabulated to show the frequency of the four difficulties. According to Table 4.21, Difficulty One was the biggest problem of all. 69.9% of the respondents chose this as the biggest problem they encountered--a lack of time in integrating IT into teaching.

Table 4.21 Frequency Table showing the Ranking of Problem One: "I don't have time preparing IT for my lesson".

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	the biggest problem	160	69.9	71.4	71.4
	not the biggest problem	64	27.9	28.6	100.0
	Total	224	97.8	100.0	
Missing	System Missing	5	2.2		
	Total	5	2.2		
Total		229	100.0		

Table 4.22 Frequency Table showing the Ranking of Problem Two: "I don't know how to integrate IT into the subject I teach."

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	the biggest problem	24	10.5	12.0	12.0
	not the biggest problem	176	76.9	88.0	100.0
	Total	200	87.3	100.0	
Missing	System Missing	29	12.7		
	Total	29	12.7		
Total		229	100.0		

Table 4.23 Frequency Table showing the Ranking of Problem Three: "I don't have enough training in IT and assistance from school."

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	the biggest problem	19	8.3	9.4	9.4
	not the biggest problem	184	80.3	90.6	100.0
	Total	203	88.6	100.0	
Missing	System Missing	26	11.4		
	Total	26	11.4		
Total		229	100.0		

Table 4.24 Frequency Table showing the Ranking of Problem Four: "I am afraid of making mistakes in the classroom which I cannot handle."

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	the biggest problem	23	10.0	11.5	11.5
	not the biggest problem	177	77.3	88.5	100.0
	Total	200	87.3	100.0	
Missing	System Missing	29	12.7		
	Total	29	12.7		
Total		229	100.0		

4.2.7 Benefits of using IT in Teaching

Table 4.25 shows the majority of respondents (64.2%) maintained that the lessons became more motivating and effective with the use of IT. Some fairly frequent perceived gains of the use of technology in the lesson were that IT allowed a more efficient use of teaching materials (27.9%), there was access to abundant, updated,

authentic material (25.3%), and it enabled the use of multimedia material for learning and teaching (21.4%). "More student autonomy" and "increased interaction" accounted for 10.5% and 15.3% respectively and were worth noticing. Only 2.2% indicated categorically that there was no benefit from the use of IT in the lessons.

A few responses indicated that integration of IT in the lessons encouraged students to use IT to learn, enabled teachers to keep abreast of the time. About two to three respondents indicated that the benefits actually depended on how the teachers used the technology. But these were just a haphazard few, so I grouped them under the category "others".

Table 4.25 Frequency Table of Perceived Benefits of the Use of IT in Teaching

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
student autonomy	24	10.5%	205	89.5%	229	100.0%
active/collaborative learning	11	4.8%	218	95.2%	229	100.0%
increased interaction	35	15.3%	194	84.7%	229	100.0%
abundant updated authentic material	58	25.3%	171	74.7%	229	100.0%
more motivating & effective lessons	147	64.2%	82	35.8%	229	100.0%
use of multi-media material	49	21.4%	180	78.6%	229	100.0%
efficient use of teaching materials	64	27.9%	165	72.1%	229	100.0%
no benefits	5	2.2%	224	97.8%	229	100.0%
others	18	7.9%	211	92.1%	229	100.0%

4.2.8 Change in the Role of Teachers and Students

Table 4.26 Frequency Table of Perceived Changes in the Role of the Teachers and Students

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
students become more active	69	30.1%	160	69.9%	229	100.0%
teachers are facilitators	75	32.8%	154	67.2%	229	100.0%
more interaction	26	11.4%	203	88.6%	229	100.0%
students can direct own learning	42	18.3%	187	81.7%	229	100.0%
students as teachers	30	13.1%	199	86.9%	229	100.0%
no change in the role	24	10.5%	205	89.5%	229	100.0%
others	23	10.0%	206	90.0%	229	100.0%

The findings about the changes in the role of the students and the teachers are displayed in Table 4.26 As regards the changes in the role of the teachers, 32.8% of the respondents indicated that the teachers became facilitators with the integration of IT in teaching. A comparable percentage referred to the belief that students became more active learners. Some other responses were also related to the change in students: 18.3 % remarked that the students were able to direct their own learning and that the students could act as little teachers (13.1%). A category referred to the change in relationship: there was more interaction in the lessons (11.4%). It was also worth noting that 10.5% indicated that there was no change in the role on both parts.

4.2.9 Use of Computer Applications in the Lessons

As shown in Table 4.27, the most frequently used applications with teachers in their main subjects taught were web browsing (44.6%), simulation (12.9%), word processing (39.1%), PowerPoint (71.3%) and drill and practice software (12.9%). These applications had a total usage rate of above 10%.

Table 4.27 Use of Applications by Teachers in the Main Subject Category they taught

	Subject Categories					
Count Row pct Column pct	languages	social sciences	sciences	cultural subjects	others	Row total
Web browsing	33 36.7 43.4	18 20.0 51.4	29 32.2 42.0	9 10.0 64.3	1 1.1 12.5	90 44.6
simulation	0 .0 .0	0 .0 .0	22 84.6 31.9	2 7.7 14.3	2 7.7 25.0	26 12.9
Spreadsheets	2 2.6 13.3	0 .0 .0	12 80.0 17.4	0 .0 .0	1 6.7 12.5	15 7.4
data base	1 25.0 1.3	1 25.0 2.9	2 50.0 2.9	0 .0 .0	0 .0 .0	4 2.0
micro computer-based lab	3 23.1 3.9	0 .0 .0	9 69.2 13.0	1 7.7 7.1	0 .0 .0	13 6.4
word processing	39 49.4 51.3	15 19.0 42.9	21 26.6 30.4	1 1.3 7.1	3 3.8 37.5	79 39.1
PowerPoint	58 40.3 76.3	27 18.8 77.1	48 33.3 69.6	6 4.2 42.9	5 3.5 62.5	144 71.3
web design	4 26.7 5.3	2 13.3 5.7	7 46.7 10.1	1 6.7 7.1	1 6.7 12.5	15 7.4
drawings & graphics	1 5.3 1.3	0 .0 .0	12 63.2 17.4	6 31.6 42.9	0 .0 .0	19 9.4
email/ICQ	10 50.0 13.2	2 10.0 5.7	8 40.0 11.6	0 .0 .0	0 .0 .0	20 9.9
programme language	1 11.1 1.3	0 .0 .0	8 88.9 11.6	0 .0 .0	0 .0 .0	9 4.5
drill & practice software	14 53.8 18.4	4 15.4 11.4	6 23.1 8.7	1 3.8 7.1	1 3.8 12.5	26 12.9
VCD/ CD-ROM	3 37.5 3.9	2 25.0 5.7	2 25.0 2.9	1 12.5 7.1	0 .0 .0	8 4.0
Column Total	76 37.6	35 17.3	69 34.2	14 6.9	8 4.0	202 100.0

Percents and totals based on respondents

202 valid cases; 27 missing cases

The use of applications by teachers in their minor subjects is shown in Table 4.28. The most frequently used applications were web browsing (45%), word processing (30.0%), PowerPoint (73.8%) and graphics (11.3%) Thus the most frequently used applications in both the main subjects and the minor subjects more or less coincided. The applications used most frequently were confined to a few categories, namely, web browsing, word processing and PowerPoint.

Table 4.28 Use of Applications by Teachers in the Non-main Subject Category they taught

	Subject Categories					
Count Row pct Column pct	languages	social sciences	sciences	cultural subjects	others	Row total
Web browsing	7 19.4 43.8	9 25.0 52.9	10 27.8 37.0	7 19.4 50.0	3 8.3 50.0	36 45.0
simulation	0 .0 .0	1 20.0 5.9	4 80.0 14.8	0 .0 .0	0 .0 .0	5 6.3
Spreadsheets	0 .0 .0	0 .0 .0	5 83.3 18.5	0 .0 .0	1 16.7 16.7	6 7.5
data base	0 .0 .0	1 33.3 5.9	1 33.3 3.7	0 .0 .0	1 33.3 16.7	3 3.8
micro computer-based lab	1 25.0 6.3	1 25.0 5.9	0 .0 .0	0 .0 .0	2 50.0 33.3	4 5.0
word processing	3 12.5 18.8	4 16.7 23.5	9 37.5 33.3	7 29.2 50.0	1 4.2 16.7	24 30.0
PowerPoint	11 18.6 68.8	13 22.0 76.5	18 30.5 66.7	13 22.0 92.9	4 6.8 66.7	59 73.8
web design	0 .0 .0	0 .0 .0	2 33.3 7.4	3 50.0 21.4	1 16.7 16.7	6 7.5
drawings & graphics	0 .0 .0	0 .0 .0	4 44.4 14.8	3 33.3 21.4	2 22.2 33.3	9 11.3
email/ICQ	0 .0 .0	0 .0 .0	1 16.7 3.7	4 66.7 28.6	1 16.7 16.7	6 7.5
programme language	0 .0 .0	0 .0 .0	4 80.0 14.8	1 .20.0 7.1	0 .0 .0	5 6.3
drill & practice software	0 .0 .0	2 25.0 11.8	1 12.5 3.7	2 25.0 14.3	3 37.5 50.0	8 10.0
VCD/ CD-ROM	2 40.0 12.5	2 40.0 11.8	1 20.0 3.7	0 .0 .0	0 .0 .0	5 6.3
Column Total	16 20.0	17 21.3	27 33.8	14 17.5	6 7.5	80 100.0

Percents and totals based on respondents

80 valid cases; 149 missing cases

4.3 Interview Findings

The interview data have been summarised in the tables below:

Table 4.29 Matrix showing the Teachers' Beliefs about the Advantages, Impediments, Drawbacks and Changes in the Role of the teachers and students in relation to the instructional use of IT

Respondent	Advantages	Impediments	Drawbacks	Change in role
A	• effective lessons • self-access learning • rich resources	• access to equipment • breakdown of equipment	• glut of information	• no
B	• effective lessons • efficient management of teaching materials • use of multi-media materials	• lack of time • lack of skills	• instant gratification---lose patience with deep processing • physical effect	• no
C	• effective lessons • efficient management of teaching materials • use of multi-media materials • taking students out of classroom	• lack of time • access to equipment	• instant gratification---lose patience with deep processing • resources in non-native language	• yes
D	• effective lessons • efficient management of teaching materials • use of multi-media materials • publication of students' work	• lack of time • lack of skills	• instant gratification---lose patience with deep processing • equipment breakdown	• no
E	• effective lessons • efficient management of teaching materials • use of multi-media materials • view experiments	• breakdown of equipment	• instant gratification---lose patience with deep processing • teaching progress restrained	• no
F	• effective lessons • taking students out of classroom	• lack of time • access to equipment	• teaching progress restrained • physical effect	• no
G	• effective lessons • efficient management of teaching materials	• lack of time • access to equipment	• equipment breakdown	• no
H	• effective lessons • self-access learning • increased interaction	• access to equipment • breakdown of equipment • inadequate resources	• teaching progress restrained	• yes, if the targets of using IT are achieved

Table 4.30 Matrix showing the Integration of IT in the Subject

Subject	resources P= publishers W= Web	Subject-related difficulties	Applications used	Successful examples of use	Suggestions for improvements
English	P: + W: +	• IT hampers interaction	PPT, WB	• grammar teaching • teaching comprehension skills • checking answers	• improve on interactivity of software • build a resource bank
Chinese	P: – W: –	• lack of time	WP, WB, PPT	• Chinese calligraphy	• improve on interactivity of software • develop more resources
Chinese History	P: – W: –	• lack of time	PPT, WB	• modern history	• improve on interactivity of software
History	P: – W: +	• lack of time • non-native language materials	PPT, WB	• showing maps and comic strips	• develop more resources
Economics	P: + W: –		WB		
Integrated Humanities	P: – W: +		PPT, WB		• improve on interactivity of software • more hardware support
Mathematics	P: + 		PPT	• Pythagorus Theorem	• improve on interactivity of software • develop more resources
Physics	P: + W: +	• lack of time	PPT, VCD, animations	• the course requirement • applying principles to problems	• more software support for test generation, analysis of test results
Integrated Science	P: + W: –		PPT		
Art	P: + W: +	• lack of time	PPT	• installation art • fashion design	• publish students' work
Physical Education	P: + 	• not relevant to subject nature	PPT	• sports safety • first aid	• integrate IT with new approach of learning

+ reasonable amounts – limited amounts WP Word Processing WB Web Browsing PPT PowerPoint

Table 4.31 Matrix showing the teachers' general views about the Government's IT Policy

Respondent	Resources	IT knowledge	Importance of IT	Future trend
A	• not enough technical support	• enough to have basic skills	• don't deify IT • more exploration into the integration of IT in teaching	• more exploration into the integration of IT in teaching
B	• not enough teaching materials and resources	• good to know basic IT knowledge		
C			• don't deify IT, just a tool • more attention paid to learning skills of students	
D	• need more software and hardware support	• basic training is good but training should continue		
E	• need more resources of a wider variety	• IT knowledge training should be more pragmatic	• can teach well without IT	
F	• need follow up in using hardware and software			• more school-based/ subject-based discussion needed
G	• quick supply of hardware but not enough room for teachers to catch up	• teachers are too busy to engage in too much training		
H		• good to acquire some skills		

4.4 Chapter Summary

In Chapter 4, we have looked at two sets of data, the questionnaire survey data and the interview data.

The survey study has yielded various interesting findings. Gender and the main subject taught, but not age, have a significant effect on the computer attitudes of secondary school teachers. Male teachers have a more positive attitude towards computer use than female. Language and social science teachers harbour a less positive attitude toward the instructional use of computers than science and cultural subject teachers.

Female teachers also use the computer significantly less than male teachers. Moreover, there is an association between the subject taught by the teacher and the frequency of use in IT. Language teachers use IT less frequently than non-language teachers, social science teachers included. On the other hand, age is significantly associated with the use of IT among the female teachers but not the male teachers.

Interestingly the computer attitudes of teachers were found to be slightly or moderately correlated with the frequency of use of IT. Other than the individual factors mentioned above, school factors also have a significant effect on the overall computer attitudes and frequency of use.

Concerning opinions over the use of the technology, a majority of teachers believed that the lack of time was the predominant difficulty in the use. Most were positive about the benefits of integration and the way it induces changes in the role of the students and the teachers. Lastly, the survey sheds light on the types of computer

applications used by the teachers, which was mostly confined to PowerPoint, web browsing and word processing.

This chapter has also presented the findings of the interview study. In the first place, they illuminate the survey data by providing more contextual elements to various aspects of the issue --- benefits, difficulties, roles and integration of IT in different subjects. In the second place, aspects not included in the survey study --- opinions about the drawbacks of the use of IT and general views about the government's IT Policy were also elicited and summarised in Tables 4.29, 4.30 and 4.31, the full version being included in Appendix V. These data contribute to the inquiry by creating a more holistic and comprehensive picture of the teachers' instructional use of the technology.

Chapter 5 Discussion on Survey Data

5.1 Introduction

Chapter 5 sets out to examine and discuss the findings about the relationships between gender, age, subject taught and school factors on the one hand and computer attitudes and frequency of use on the other. Next, The teachers' perceptions about the main impediment to their use, the benefits of using the technology and the changes in the role of the students and the teachers involving information technology are also discussed. Lastly the significance of the pattern of computer use in the classroom is also investigated.

5.2 Gender Effects

5.2.1 Gender and Computer Attitudes

It was suspected that the gender differences identified in previous research conducted a decade ago might have grown outdated with the prevalence of computer use in the new millennium. Findings in the present study have revealed that a significant difference existed between the two genders of secondary school teachers in computer attitudes. Thus the Null Hypothesis was rejected. The male teachers had significantly higher scores than the female teachers in all three dimensions of the computer attitudes---computer anxiety, computer confidence and computer liking. The findings corroborate with those from previous research studies that males have more positive attitudes towards computers than females (Brosnan & Davidson, 1994; Brosnan, 1998; Lee, 1997; Shashaani, 1993; Todman, & File, 1990; Todman, 2000). The respondents in many of these studies were students and primary school teachers in the Western countries (Campell, 1990; Rosen & Weil, 1993; Todman & Dick, 1993; Todman, 2000), the present study on secondary school teachers in Hong Kong does add empirical support to

the theoretical prediction.

Initially, it was suspected that the gender difference in computer attitudes might have been diminished with the prevalence of computer use in society these days. The findings in the current study has shown this gender difference still exists among Hong Kong secondary school teachers. To start with, the computer is still stereotyped as a masculine science subject (Brosnan, 1998; Hawkins, 1985; Lee, 1997). In Hong Kong, as in the West, computer studies is perceived as a male-dominated discipline in universities and there is a low enrollment rate among women (Brosnan, 1998; Dryburgh, 2000). Dryburgh (2000) has found that Computer Science graduates who are women were declining in the last fifteen years. In schools, the subject is also predominantly taught by male teachers (Weber, 1990). Girls perceive computer studies as being a masculine subject such as Physics and Engineering and see themselves as less capable than boys in computing. Video game centres and school computer rooms are almost exclusively occupied by male students (Hawkins, 1985; Wilder, Mackie & Cooper, 1985). Children sort out objects and activities that are appropriate to themselves since they are very young (Wilder, Mackie and Cooper, 1985). Parents also play a part in this socialization process. Computers and computer games are bought for boys. Thus, the tendency towards sex typing of computers has taken root at an early stage in the secondary school teachers' life. This deep-seated belief that the world of technology is a male domain lingers on and continues to affect their computer attitudes even after they become teachers.

Another plausible explanation of the difference is that females in general consider themselves more capable communicators and are more inclined to

engage in activities which emphasize human touch. They see themselves as better at handling people than at the impersonal "computing machines" Hence their attitudes are affected by their perception that the computer is not their area of strength. Schott and Selwyn (2000) comment on the persistent stereotype of "the frequent computer user" being one of a male, socially inadequate and isolated individual." Lockheed (1985) also refers to our conception of computer users as one of "insensitive rule-oriented males with a lust for winning." Thus the female teachers perceive an incompatibility between their disposition and their job nature on the one hand and the machine on the other. This notion does affect their attitude to, liking for and confidence in the use of computers. After all, teaching is very much a profession of working closely, with a high degree of sensitivity, with humans, whether students or fellow teachers.

There is a body of research studies which highlight the difference in computer experience between males and females (Becker, 1985; Colley, et al, 1994; Lockheed, 1985). Busch (1995) claims that with the effects of prior experience and encouragement removed, there was no gender difference. Most of these research studies were done on school students a decade ago where equity of access to the computer, modelling of family members, etc. were relevant. In the case of the secondary school teachers in Hong Kong, however, the computer has become a ubiquitous object in the new millenium. Every teacher's household has at least one personal computer these days. Cyber cafes are everywhere. Further research is needed in order to gauge the relationship between computer experience and the teachers' computer attitudes these days.

That the female teachers scored significantly lower in computer attitudes is a

cause for concern since the teaching profession is basically dominated by women both in secondary and primary schools in Hong Kong. Todman and Dick's research yields findings that pupil-teacher attitudes were positively correlated in primary schools (1993). It would be interesting to know to what extent the computer attitudes of the teachers impact secondary school students. Saunder (1993) mentions an anxious role model's reinforcing the genderization of technology. Bohlin and Hunt (1995) echo the idea that attitudes can be unconsciously transferred to students through modelling. They seem to catch computer anxiety from their anxious teachers.

The present study yield the finding that the female teachers scored significantly lower than the male teachers in computer attitudes but their scores were well about 60% of the total. The average computer anxiety, confidence and liking scores of the female teachers were 36, 32 and 31 respectively, compared with 40, 36 and 34 of the male teachers. Further investigation should be done to see whether the scores were too low to warrant redress. Were the scores so low as to raise the alarm? Would there be an effect on the students? In other words, a bottom line should be determined to see "how low is too low". Moreover, an international study can be done to compare the secondary school teachers of different countries in relation to computer attitudes and see what contributes to the differences if any.

It is also interesting to know that both the male and female teachers decreased in scores from anxiety dimension through confidence dimension to liking dimension From the low mean and median scores for computer liking, we can tell that most teachers were not really very fond of using the computer. Their fondness scores

of the technology were even lower than that of their anxiety scores. Perhaps, the computer is seen as a tool or a practical aid for teaching rather than something they enjoy spending much time engaging with.

5.2.2 Gender and Computer Use in Class

According to the findings, the frequency of use of IT was significantly associated with gender. The null hypothesis was rejected. The results reinforce the findings about gender differences in computer attitudes. Thus we can see that gender differences not only reflect in attitudes but also in actual practice.

At least half of the male teachers used IT in their teaching frequently while for their female counterparts, less than one third of them did so. On the other end of the spectrum, more than one third of the female teachers indicated they seldom used the computer in teaching while the percentage for the male teachers, was comparatively lower, 22%. It suggests that the attitudes of the teachers are correlated with their actual use of computer technology in teaching.

Male teachers have more positive computer attitudes and thus are more willing to use computers than the female teachers. This gender difference in computer use in teaching is congruent with what was found in various studies. Becker (1985) identified that men have greater personal involvement in computers. They tend to dominate the home computer for playing games and programming (Lockheed, 1985). Women, by contrast, are by nature more inclined to interacting with people than with the machine. They tend to use the computer less often than men.

The gender difference in the use of computer in teaching can be explained by the

differential degrees of technological innovativeness. Braak (2001) contends that the willingness to change teaching through technology is the chief predictor of computer use. Women were found to be more pessimistic about new technology and more cautious in their interpretations of technological innovations than men (Hackett et al, 1991; Mitra, et al 2001). Thus the more positive attitude toward an innovation also explains why men use the computer more in the classroom.

As I mentioned in the previous section the gender-biased classroom practices may rub on to the students and reinforce the self-fulfilling prophecy of gender difference. Thus the issue should be attended to in the educational setting.

Some maintain that it is worrying to have so many anxious, female "introducers of technology" (Brosnan, 1998). Teaching practices have been found to reduce anxiety in children (Hunt & Bohlin, 1995). They also argue that there is a need for all teachers to be technologically informed about computers in order to properly and successfully develop a student's capability in technology. While I strongly agree that teachers' anxiety need to be reduced, I do not think that teachers are always the "introducers of computer technology" or that the teachers are always more "informed and competent" than students in terms of computer technology at least in this new millenium in Hong Kong. In Hong Kong, the computer has become so common in every household and the use of the computer has actually infiltrated every aspect of human life in such a way that we practically cannot do without it. In fact the use of computers among school teachers has yet to catch up with the pace of the outside world. In this new age of computers, school children take to computers like fish take to water. With the prevalence of computers in their stage of growing up, children of this generation

feel more comfortable and a lot less anxious about the computer than their predecessors. It is the teachers who have to speed up and relearn. In fact, teachers in general often learn from the students as far as computer technology is concerned. (I will return to this "student as teacher" idea in the later section.)

Action or the lack of action is directed by attitudes. In practical terms, IT training for teachers has to address the affective elements of teachers, especially female teachers, helping them to overcome their fear of technology. Technophobia reduction programmes should be organized. Research has confirmed that females learn more confidently in the computer class when they are separated from the male colleagues (Lee, 1997). Thus women-only training providing a non-threatening environment can also be considered in schools where the problem is acute. The IT training should enable the teacher to get something useful and relevant. When they find their knowledge is practical, pragmatic and relevant to the subject they teach, they will have more incentive to use the computer in their teaching.

A collegial sharing culture should be developed because female teachers, in particular, are prone to share and seek help when they are in trouble with the computer. What is also important is that a different culture be established among the teachers, not only female teachers---a culture of collaborating with students. If the teacher assumes that he is the imparter of knowledge, he will be afraid of appearing stupid for not being able to fix a computer problem in class. This will give rise to great anxiety and reluctance in using the computer. A new mode of thinking has to surface. The teacher cannot assume that he/she knows all. As I mentioned above, the student can be more agile with the computer or can help fix

a computer problem. The teacher should regard this not as a threat to his/her "status" in the classroom but an opportunity to learn from each other or a collaboration in conducting the lesson smoothly. It is only with this mentality that the student who is competent in computers would not negatively impact on the teachers by making him/her more anxious and refrain from using IT.

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5.3 Age Effects

5.3.1 Age and Computer Attitudes

Another part of the study was set out to examine the relationship between age and computer attitudes. I anticipated that the younger the age of the teachers, the higher the scores of their computer attitudes. In the first place, the younger teachers have undergone more comprehensive computer training in the teacher college, which is becoming a prerequisite for graduation. Moreover, the younger teachers have more or less grown up in the computer age. They are more used to the technological mode of life than their older counterparts. Thus it was assumed that the younger group of teachers were more competent and less technophobic.

The introduction reviewed literature which identified a significant relationship between age and computer attitudes. For example in the study of Jennings and Onwuegbuzie (2001), the youngest group of students reported less computer anxiety and higher levels of confidence. The oldest students reported a higher level of computer liking.

The current study predicted a relationship existed between the two variables. The research hypothesis was tested. The ANOVA test analysis indicated that the Null Hypothesis could not be rejected. In other words there was no significant

difference in computer attitudes among different age groups. This is in contradiction to the prediction of the study and the findings in Harrell's study (2000).

Probably other factors played a more important role in influencing computer attitudes in my study; for example, gender and subject nature. Age is not a salient factor here. Harrell's study was confined to the English instructors of community colleges in UK while Jennings and Onwuegbuzie's research was on undergraduates. Further studies are needed to shed light on the relationship between the two variables of secondary school teachers as a whole.

5.3.2 Age and Computer Use in Class

No significant relationship was identified between computer attitudes and age. But interestingly findings revealed that a relationship did exist between age of the female teachers, though not the male teachers, and the actual use of IT in teaching. The Null Hypothesis was rejected.

In the case of female teachers, the frequency of use of the computer decreased with age. A significant relationship between age and computer attitudes was not found, so the pattern of use would not be accounted for by the computer attitudes. Age and the related years of teaching account for the inertia in the use of IT in teaching, as in the case with many other educational initiatives in general. Teachers of the last two groups have been in the profession for over twenty years. The idea of implementing the "new" technology does not appeal to them because they believe what has worked for them continues to work well. They are more prone to fall back on their old, familiar way of teaching rather than exploring new

ground in incorporating IT into the subject they teach. With abundant teaching experience, they believe they can survive. They resist changes that appear to threaten basic securities. Furthermore, this group of teachers themselves were taught in a computer-free classroom of their time and their upbringing also adds to the resistance to change.

Interestingly, for the male counterparts, comparatively more teachers fell into the "often" category in each age group except the last one. For the 47 or above age group, most male teachers seldom used the technology. There was not a distinctive pattern as in the female teachers. Obviously, gender is a salient factor in the use of computers in teaching and age seems to have a stronger influence on the female gender than the male.

The present study suggests that though age has an effect on the use of computers, it is not a salient one. The combination of age and gender would exert a stronger influence on the use of computers. The limitation of the study was that the number of respondents in the last age groups was small. That actually affected the power of the study. Further studies would focus more on the difference in use among these age groups, paying more attention to the number of respondents.

5.4 Subject Variable

5.4.1 Subject taught and Computer Attitudes

Other than gender and age, the relationship between computer attitudes and the main subject taught was examined in the present study. There is always a preponderance of female teachers in the language department of a school, so it was suspected that the gender factor might skew the results of the subject

analysis. In view of this, a test for interaction was run and the results confirmed that there was no interaction between the two variables, gender and subject. Then the subject variable was tested as a main factor on the teachers' computer attitudes. Results supported the rejection of the Null Hypothesis. In other words, a significant relationship existed between the main subject category taught and the computer attitudes.

The findings revealed that teachers of the language subjects and the social science subjects scored significantly lower in computer attitudes than science teachers. The difference was particularly marked in computer anxiety and computer confidence. As literature has revealed, the computer subject has always been regarded as a science subject. In Stevens's study (1980), 84% of teacher educators thought that it should be mathematics teachers who take responsibility for teaching students about computers. Other studies have highlighted the fact that computing seems to be strongly associated with the scientific/mathematical end of the curriculum and is hardly seen in the English department (Gardner, McEwen, & Curry, 1986). It is also noted that conditions have been established for an institutionalized bias against the effective use of computers by humanities teachers (Russell, 1989). In the light of this mentality, it is not difficult to comprehend that language teachers and social science teachers harbour less positive attitudes towards a "science province" with which they consider they have less affiliation.

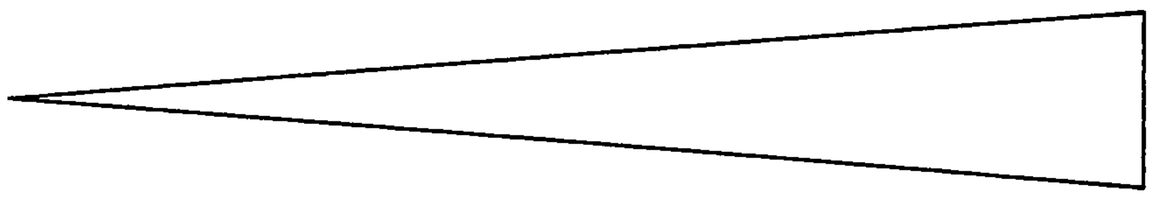
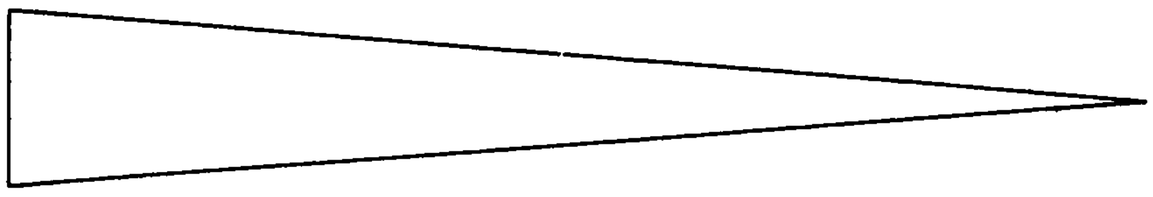
There was a significant relationship between the subject category taught and computer anxiety and confidence but not computer liking. Some teachers may be anxious about the use of computers, but they do appreciate the usefulness of

computers in teaching their subjects. Therefore there was not a significant difference in their computer liking dimension.

5.4.2 Subject taught and Computer Use in Class

According to the findings, there was a significant relationship between the subject categories taught and the actual usage rate of the computer. Thus the Null Hypothesis was rejected.

Nearly half of the language teachers (46.2%) seldom used the computer in their lessons. The pattern reversed for the other subject categories. Except for language teachers, the proportion of teachers who often used the computer was the biggest (52.8% for social sciences, 56.9% for sciences, 49% for cultural subjects and 80% for other subjects). On the other hand, one third of the language teachers used the computer in their teaching sometimes and not many of them (18.7%) used the computer often. The triangular pattern was reversed for other subject categories. The smallest proportion went to the "seldom" category.

	Often seldom
Language subjects	
Non-language subjects	

The usage pattern for the language teachers was unique, standing out from that

for the other teachers. The language subject is a female-dominant discipline. At a glance, it seems to suggest that the low usage rate resulted from the preponderance of females in these departments. But even when the female and male teachers were considered separately, there was still a significant difference in the usage rate between the language teachers and the non-language teachers.

As I mentioned in the subject-attitude section, the computer is traditionally subsumed under the science province. The language and social science teachers do not feel comfortable about using an innovation not in their territory. In Wilder, et al's wording, "attitudes towards computers are mostly like reactions to science and, to a lesser extent, math…and least like reactions to writing." (1985:221) The study by Eckman (1996) lends support to the phenomenon that many instructors are uncomfortable with the use of computer technology in the English classroom or fail to see its relevance to their teaching practices or philosophy. Hawisher & Selfe (1991) also suggest that English departments tend to be more resistant and slower to change, especially in the use of technology, than other departments.

It is very likely that language teachers use the computer less often also because of factors related to the subject itself. The second part of my study, the interview, has yielded findings which revealed that the nature of the subject, amount of resources available to the subject teacher, etc. have influenced the teacher's usage of IT in the lessons.

As revealed in the attitude data, social science teachers, like language teachers, scored significantly lower in computer anxiety and confidence scores than science teachers. Interestingly enough, the usage rate of IT of the language

teachers was congruent with their computer attitudes while that of the social science teachers was not. 52.8% of the social science teachers often used the technology, which is comparable to the science teachers (56.9%). In fact, only 8.3% of the social science teachers seldom used the computer in their teaching while the figure for the science teachers was even higher, 23.6%. Thus it elucidates the phenomenon that there is not always a direct correlation between the computer attitudes and the frequency of use. Apparently, other factors come into play, which I shall return to in the interview section.

The high usage rate revealed in the social science teachers also sheds light on my previous finding that there is only a significant difference in computer anxiety and confidence, but not liking, between social science and science teachers. More research needs to be done to look into the issue as Marcinkiewicz (1993-94) suggests, " To understand how to achieve integration, we need to study teachers and what makes them use computers, and we need to study computers and what makes teachers want to -or need-to use them." (p.224)

5.5 Attitudes and Behaviour

The correlation between frequency of use and computer attitudes was positively related. The higher the computer attitude scores, the higher the frequency of use. Therefore the Null Hypothesis was rejected and the result lends support to the postulation that attitudes are significant predictors of commitment to the use of computers (Busch, 1995).

Though the frequency of use was correlated with computer attitudes, the correlation was not a strong one in this study (.21 for computer anxiety, .33 for

computer confidence and .30 for computer liking). Many factors intervene that also affect behaviour other than attitudes (Eiser & Pligt, 1988). Braak (2001) states that favourable attitudes toward computers are only a single factor in a chain of factors needed to understand computer use.

Aside from the factors I looked into in the present study: age, gender and subject taught, Braak puts forward the idea of innovativeness as an essential factor in the understanding of computer-related behaviour. In his study he concludes that technical innovativeness, the willingness to change teaching through technology mediates the effects of computer attitudes on class use of computer. In their study, Ross, Hogaboam-Gray and Hannay (1999) also conclude that teachers with greater confidence in their instructional abilities are more likely to try to implement innovative practices and to persist through obstacles.

Other than the individual characteristics, various external factors affect the teachers' use of the computer in class. Teachers' instructional use of technology is moderated by school factors (Ross, et al, 1999). The teachers are subject to the policy and requirements of individual schools and the Education and Manpower Bureau. There are many pragmatic factors. For example, does the school render easy access to resources? Is the school a learning institution? Is there a supportive, collaborative school ethos? Does the school mandate the use of IT in teaching in line with the IT policy of the government or adopt a laissez-faire policy? Is there leadership for change? These are issues worth further investigation.

5.6 School Differences

In six of the schools, 46-60% of the teachers used the computer frequently. On

the other end of the spectrum, 58% and 65% of the teachers of two schools seldom used the computer in their teaching. In three schools, the frequency of use was fairly evenly distributed among the teachers, with about one third of the teachers falling into each frequency category.

The relationship of computer attitudes and frequency of use among different schools was examined and a significant difference was identified in the computer attitudes and the frequency of use among the schools in the survey. Thus the Null Hypotheses could not be retained.

It seems plausible that the cultures of the schools account for the differences in use. If the school has a strong positive culture of using IT more teachers will be willing to use the technology. The positive culture may include a better IT supportive system, useful staff development, a better sharing culture among the colleagues and a more encouraging policy from the school administrative level, etc.

In this study, the sample for some schools was not big enough. Moreover in one of the schools, a majority of the teachers who returned the questionnaires happened to be language teachers. These are limitations of the findings. A follow-up on this part of the study can focus on what actually contributes to such big differences among schools. Case studies can be done to look into the culture of very active and passive schools. It is worth investigating this aspect as this would throw light on how to better promote the use of IT in teaching and what to do to prevent the inertia of teachers in using the computer in teaching.

5.7 Difficulties faced by Teachers

Literature has identified some major difficulties faced by the teachers in integrating IT into the computer. Lack of knowledge on the teachers' part may constitute a serious obstacle to the integration of ICT in secondary schools (Brummelhuis & Plomp, 1994; Mooij & Smeets, 2001). In the international study conducted by Smeets et al (1999), the most important reason teachers mention for not using ICT is that they are not familiar with ICT, or they feel unsure about it. Other significant barriers mentioned in the literature are lack of access, support, time, etc. (Brummelhuis & Plomp, 1994; Lee, 1997; Ross, et al 1999).

In my questionnaire, I included four oft-mentioned impediments to integrating IT into teaching and looked into their relevance to the Hong Kong secondary school teachers. They were, not knowing how to integrate IT into teaching, not having time to integrate IT into teaching, not having enough IT support from school and fearing to appear stupid when making mistakes in the class.

The findings revealed that "I don't have time preparing IT for my lessons" was deemed the biggest problem faced by teachers. It amounted to an overwhelming majority of 69.9% In the case of Hong Kong teachers, lack of knowledge (10.5%) IT support (8.3%) and confidence (10.0%) were not the major difficulties facing them. The lack of time was considered the most important factor affecting their use or lack of use. In general, Hong Kong teachers perceive themselves as overloaded. The use of IT in their lessons requires extra time, which they find it hard to squeeze. The situation is ameliorated by the deluge of educational reforms implemented by the government in recent years---School-based

Management, Medium of Instruction Policy, IT Policy, Language Proficiency Assessment, etc.

In fact, from the onslaught, some people have been considering IT a panacea to educational problems. I think IT was never meant to save time for teachers or reduce their workload. On the contrary, to effectively integrate IT into teaching, teachers have come to realize that they need even more preparation work or spend even more time on preparing. This is a pragmatic problem teachers of Hong Kong have to face.

To ease the workload of the teachers and to encourage them to use IT in their lessons, we have to address their practical concern. Teachers are not satisfied with knowing just the general skills of presentation. These are too general and cannot address the specific needs of the subjects they teach. More support packages on the use of IT in teaching should be given. For example, there should be local educators developing more subject-specific software or computer-supported teaching aids for teachers (Yaghi & Ghaith, 2002). It is also essential that the teaching materials and software developed cater for the needs of Hong Kong students. For example, people who design these teaching materials can take into consideration the learning environment and the language policy in Hong Kong schools (MOI). Educational software in the students' native language, Chinese, should be developed to cater for the majority of local students. There is little incentive in using foreign –produced software which is not custom-made for the Hong Kong curriculum and which uses English as the medium of delivery. Teachers need more support in this respect for they are too busy to produce software on their own.

Besides, there should also be a better sharing culture within and without schools so that teachers will not feel alone in the face of the requirements of the policy and they will have room to practise the integration of the computer into the subject for the sake of improving teaching effectiveness.

5.8 Benefits of Incorporating IT in Teaching

60% of the non-user teachers in a study indicated that the educational value added by the computer was not clear to them (Brummelhuis & Plomp, 1994). The inability to see the relevance of the machine to teaching contributes to the low utilization rate. Gauging what teachers in Hong Kong believe about the value of using the computer technology can cast light on what would motivate them to use it and the manner and context in which the technology is employed. It also informs on what weighs heavier to them in teaching.

In the present study, a majority of teachers believed that using IT is conducive to teaching. Only 2% said they recognised no benefits at all. Most teachers (64.2%) believed that a motivating lesson is a benefit of using IT in the lesson. This confirms DiSessa's (1988) comment that computers are "intrinsically engaging" and Feurzeig's (1988) remark that "computer can be used to create motivating learning environments". This is related to the gain that IT allows the use of multi-media materials (21.4%). It allows students to engage in the lesson more. Some teachers exemplified their point by saying that the teaching of many abstract concepts can be facilitated by the use of 3-D figures and simulation. The visual effects and the acoustic effect work to the benefits of the students.

27.9% of the teachers believed that IT also allows a more effective and efficient

management of the teaching materials. For example, many teachers remarked that the use of IT saves much time used for blackboard writing. In other words teachers do preparation with their computer beforehand and save time used to write on the blackboard during the lessons. The teaching progress can be made more efficient and the teaching time can be saved in a way. The materials can be easily stored, retrieved and recycled in another class. Editing and revision can be easily done and so some teachers expressed that it is more environmentally friendly in that it saves time and paper. Kulik and Kulik (cited in Geisert & Futrell, 2000:201) remark that computer-based instruction has yielded substantial savings in instructional time. Some teachers also mentioned that the teaching material can be shared among colleagues more steadily with the use of the computer. Teachers can use the material and edit them for their own purpose more conveniently. This echoes Poole's remark (1997: chapter 1):"Innovative teachers are thus able to share their expertise---duplicate lessons that incorporate the ever-increasing stock of computer-based teaching aids by making these lessons available to colleagues."

To bridge the gulf between the classroom and the real world, Feurzeig (1988: 303) believes "computers can be used to create and support the knowledge sources, learning environments, and instructional tools necessary to foster this kind of cognitive development". Davis et al (1997) also says computer tasks can be more authentic than traditional tasks. Indeed, with the access of a wide range of information sources through the Internet, students can be exposed to learning opportunities which offer the kind of spontaneity and authenticity often unavailable in the contrived setting of the classroom. In the study, quite a number of teachers mentioned this as an advantage of using IT to teach. 25.3% of the

responses were that IT allows the teachers and students to have more access to the Internet, which is a source of abundant, updated information. Some believed that more authentic tasks can be administered with the easy access to up-to-date information.

As regards student autonomy, 10.5% of the teachers believed that many students can take learning more independently with the use of IT. For example, learning can extend beyond the classroom and they can learn at their own pace. Self-learning and self-assessment are made more plausible. Traditional classrooms make no allowance for students to move at different rates through the material, perhaps reviewing individual learning sequences where necessary. But the computer makes individualised pacing convenient and commercially practical (Taylor, 1980).

Much literature has explored the importance of IT in promoting cooperative learning and interactivity (Crane, 2000; Davis, et al 1997; Slavin, 2000). Only 15.3 % of the responses in the present study referred to that there was more interaction in the lesson between the teachers and the students. In other words, learning in the classroom becomes not so passive but more dynamic. Perhaps teachers in a Chinese society generally do not cherish a "very interactive" classroom. Students are used to being spoonfed passively. Moreover, the class size is generally big (forty or more than that) and teachers have to maintain good discipline. Thus not many teachers normally see interactivity and collaboration as an advantage. That explains why the percentage of teachers giving this response was not as high as the other gains.

It was, however, also noteworthy that in the "others" category, a few teachers gave interesting responses. For example, some expressed the idea that teachers are able to keep abreast of the time by using IT. Some remarked that teachers would not be left out in this computer age. They would not lag behind. A few said that computer software allows students to learn logical thinking, creative thinking and problem-solving skills more easily. Some teachers showed reservation about the extent IT is used. Some exclaimed that it is not used to the full and also the use is often limited to the mode of presenting information and hence the full potential gains of IT have not been effectively tapped.

In brief, the majority of respondents would subscribe to the values of using the technology. On the other hand, however, the most often mentioned beneficial effects were those geared towards the traditional teacher-centred approach to teaching: engaging students more in the lesson, saving time in writing on the blackboard, etc. Only a few suggested benefits which point to the reformatory nature of the computer in a class organisation. In other words, cooperative learning, increased interactivity, empowerment of the student, increased student autonomy, etc. were not put down as often.

5.9 Changes in the Roles

A frequency count was done on the perceived change in the roles of the teachers when IT is integrated into teaching.

Nearly one third of the responses were that the teachers became facilitators with the integration of IT in teaching (32.8%). They believe that with IT, teachers are no longer the sole source of knowledge. They are facilitators, guides or mediators

(Forsyth, 1996; Poole,1997; Roblyer, 2003; Tiene & Ingram, 2001). Many other responses were related to the change of the students' role. 30.1% of the responses were related to the belief that the students become more active. They are encouraged to explore knowledge on their own This is supported by much literature about IT. "…the role of the learner changes from one of primarily being a recipient to one of being a participant….the learner becomes a searcher with a level of responsibility for their learning ." (Forsyth, 1996:32).

The use of IT can empower the students. 18.3% of the teachers responded that with IT in teaching students can direct their own knowledge in that they can learn at their own pace, they have more autonomy in their learning, and the lesson becomes more student-centred.

13.1% of the teachers remarked that with IT students can present information to the class and they themselves can act as little teachers. In fact teachers can learn from students not only in subject knowledge but also in the computer knowledge. As a result of this change in the nature of interaction, the roles of teachers and learners can become less distinct. "…indeed the roles may even be reversed at times, as students find themselves having to explain their thinking to teachers, in order to enable teachers to understand." (Davis et al, 1997:15). In some cases students are more adept at the computer than the teacher and can be a collaborator in the use of IT in the lesson.

A certain number of teachers believed that the use of IT changes the relational process in the classroom. There are more interactions between the two parties. There are also interactions between the computer and the students and among the

students themselves. Collaboration is more feasible with the use of IT.

10.5% of teachers said that there was no change in the role. They believed that in the Chinese culture, teachers always take the lead in a classroom. Some exclaimed that with the present teacher-student ratio, it is difficult to change the role of both parts because there is such a big class size. The teacher has to be in control. Some said that there could be more discipline problems with the use of IT because the teacher is no longer the centre of attention.

As regards the changes in roles and the benefits of using the computer in teaching, most respondents gave positive responses. I suspect that some responses put down reflect what the teachers anticipated rather than what they really experienced. Therefore the ensuing interview would serve as a triangulation of the teachers' perceptions in the questionnaire survey.

5.10 Use of Computer Applications

The use of applications was confined to a few types—namely Web browsing, PowerPoint and word processing. No wonder some teachers expressed that there is no fundamental change in the classroom dynamics because IT was only used as a way of presenting information through PowerPoint and word processing. Moreover these are the easiest ways of employing IT in terms of technical sophistication. Web browsing was also used quite often. Very little was done to explore into how IT can engage students into more collaborative work in the lessons.

With the implementation of IT policy since 1999, we should applaud the effort

made by secondary school teachers to experiment the integration of IT in teaching. Of the 229 teachers surveyed, 70.7% of the teachers sometimes or often used the technology. The percentage is a satisfactory one at least for a start. It is, however, suspicious that the seemingly high usage rate is a product of the push of IT policy in the last few years. The teachers have also been required to pass the IT assessment. Once the "craze" dies down and the proficiency requirement is fulfilled, the "campaign" will cool down and many non-committal users who jumped on the bandwagon may drift away.

On the other hand when we examine the actual use of IT in teaching, the applications used were mostly confined to those entailing lower level skills, namely PowerPoint, word processing and web browsing. The variety was limited and in fact, PowerPoint and word processing are chiefly used for presentation of teaching points in lessons. There is a worry that the use of IT at this stage is only cosmetic or window-dressing.

In order for the merits of IT to be fully tapped, use of IT has to go hand in hand with the current educational reforms. Change should evolve from inside, addressing the crux of educational problems. The renovation involving IT should be in line with the change in the whole teaching approach and the underpinning mindset. For example, there is little point in using word processing or browsing the web in the writing lessons if the traditional product approach to writing is not changed to the process approach. Browsing the web can be part of the pre-writing stage in getting ready to write. The word processing application in fact should be used in facilitating the revising and editing processes. It serves more than just making the essay a neat and tidy piece.

The PowerPoint is indeed a more efficient and effective way of presenting ideas than the chalk and board in class because of the visual and sound effects that go along with it. But if the use of IT stops short at this point, before long, the PowerPoint can also become boring once students are used to it. It will become just another piece of tool for the one-to-many presentation mode in the same old teacher-centred classroom. It is of little difference to the chalk and board.

The implementation of IT should not be seen as a stand-alone endeavour. It should couple with and buttress the current educational reforms. For example, if teachers do not see the value of students actively constructing knowledge themselves, or the merits of cooperative learning in the classroom, if they do not believe in a student-centred classroom practice, the use of computers in teaching can only be superficial, restrained and taken as a mandate.

Though teachers should not use IT in the classroom just for the sake of using it, it indeed serves as a means to effect and catalyse reforms in education. Therefore teachers need concrete support and training as for how to truly and fully integrate IT effectively in teaching and how to effect changes in education through using IT in teaching. In other words their training should not only focus on the technical know-how. They need to understand the rationale of using IT and the role of IT in the broader picture of educational reforms.

5.11 Chapter Summary

Despite the equity of access to the computer in today's Hong Kong, the gender effect can still be observed on secondary school teachers. Female teachers demonstrate a less positive attitude towards the computer and use the technology

less readily in teaching. Apart from launching technophobia reduction computer programmes, there should be a more prevalent collegial sharing culture within and among schools. Besides, teachers and students should collaborate more in instructional use of technology.

It was first expected that age would have a significant effect on computer attitudes since the teachers did not all grow up in the computer age or study in a computer-mediated environment themselves. However, no significant age effect was identified on computer attitudes. On the other hand, it was found that female teachers of higher age use the computer less actively than their "younger" counterparts. With richer teaching experience, the former seem to settle down in their current practice. Interestingly, no such phenomenon was identified among male teachers. Male teachers are generally more ready to experiment with the innovation regardless of age.

The language and social science teachers have less positive computer attitudes than the science teachers. The science teachers may possibly view the computer as a science tool and generally harbour more favourable attitudes towards it. Interestingly despite their less positive computer attitudes, the social science teachers display a fairly high frequency of use. They use the technology fairly frequently in their teaching. It is likely that other than the affective factor, the nature of the subject, the degree of relevancy of the technology to the subject, the amount of resources available, etc. all play an important part in influencing the amount and frequency of computer use. This aspect will be further discussed in the chapter on the qualitative study.

Apart from individual factors, the ethos of the school, the availability of resources, the management of the change process, the learning culture, etc. may carry weight on the overall attitudes and usage of the computer. The factors contributing to the differences among schools in the implementation of the IT Policy are worthy of further investigation.

The lack of time is perceived as the predominant hindrance to the teachers' use of the technology in the classroom. More subject-specific software tailored for the classroom setting and curriculum needs of Hong Kong has to be developed and apt school-based assistance should be rendered to teachers to effect the change process.

A majority of teachers believe that IT benefits their teaching and the students' learning but only a small proportion of teachers mention benefits related to a student-centred classroom. Most believe that the implementation results in the change of their role and the students' role. This is in stark contrast to the interview findings, which I shall return to in the next chapter. The pattern of use in computer applications being confined to PowerPoint, Web browsing and word processing has illustrated that the current use is restricted to the mode of presentation and of lower level skills.

Chapter 6 Interpretation of the Interview Data

6.1 Introduction

This chapter sets out to interpret data collected from a different method of inquiry, an interview with eight teachers who frequently use information technology in the classroom. It illustrates if the data coincide with those from the quantitative survey. The qualitative method of investigation also gives rise to a more complete, holistic and contextual portrayal of the issues being scrutinised.

6.2 Why IT?

In the questionnaire administered to teachers, an open-ended question on the benefits of the use of IT was asked. The question was repeated in the interview schedule to triangulate the data obtained. The phrase "from your experience" was specifically used in the interview question to ensure that those views elicited did not reflect what the respondent assumed to be, but what he/she experienced from practice. The question on benefits was preceded by a question on the reasons why the respondent used IT in teaching.

In answering the question about the reasons for using IT in their lessons, interestingly, all respondents referred to the advantages of using IT. No one indicated that it was owing to a mandate from the school or the Education and Manpower Bureau. Actually one indicated that "using IT is the requirement of the age and even without any mandate from above, the teacher should try and learn to use it." Apparently, to these teachers, at least the frequent users, they were attracted to the use by the merits of using the technology in the lessons.

According to Table 4.29, the most frequently expressed advantages coincided

with those in the quantitative data. All eight respondents remarked that IT contributed to the effectiveness of teaching and most indicated that IT benefited them in the effective use of the teaching materials. These were also the two most frequently mentioned advantages obtained from the quantitative data, which amounted to 64.2% and 27.9% respectively.

The benefits elicited by the teachers are matters of pragmatic and central concern to a teacher--- whether the lesson is motivating and engaging, whether a topic is effectively delivered and whether the teaching materials can be effectively used and stored, etc. Therefore in both the quantitative and qualitative sets of data, these are the most frequently given responses to the question of the benefits of the use of IT. On the other hand, students' becoming more interactive or actively involved in class and the enhancement of students' self-access work have a comparatively lower ranking among the respondents both in the quantitative (20.1% and 10.5% respectively) and qualitative (3 and 1 respectively) data.

I think it has something to do with the way IT is used in the class so far. At this stage, IT is mainly used as a presentation tool in class (see section below). As indicated by some respondents, the use of IT is more dynamic and engaging as a presentational tool since multimedia elements can be included. (Appendix V)

> *"Students are interested in watching images."*
>
> *"better visual effect than the books and OHP, the pictures are large and clear on the screen; hence better teaching effect."*
>
> *"Move diversified audio-visual materials, comics, music, pictures, etc. can be used."*

The use of multimedia materials enables the teacher to explain abstract concepts more easily.

"better grasp the concepts which cannot be verbally explained clearly."
"can better grasp the abstract concepts in Physics."

The students learn more effectively because their attention can be more easily focussed.

"It's easy to focus students. Good to teach reading comprehension and vocabulary with the passage on the screen."
"Students easily fall asleep with just chalk and talk"

Six respondents also expressed the idea that the computer benefits them by facilitating the production, adaptation, use, sharing and storage of teaching materials.

"Prepare them in advance and you just follow the PPT in class, there's a clear flow."
"More convenient and save time in preparing teaching aids with the digital camera...In the past, the slides and OHP had to be developed in special shops."
"In principle, PPT is prepared once for different classes and several years"
"easy storage now... the transparencies are difficult to keep"
"You just scroll up and down the screen but the blackboard writing may have been erased."
"We can share work with other schools through the web."
"Build up materials in a data bank...they can accumulate and be recycled"
"Videotape the demonstration process and the teacher doesn't have to repeat the demonstration five times."

The computer is mostly utilised for presentation: PowerPoint. At this stage, not so much emphasis is put on the way the computer promotes interactivity, cooperative learning, the autonomy of students, etc. In other words the use of IT in class is still not quite diversified. Therefore the above-mentioned areas were not referred to so often in the responses concerning benefits.

An interesting point raised by some teachers, not indicated in the questionnaire is

that IT can bring students outside of the classroom

> *"IT brings students outside of the classroom, putting them in different situations to experience things they need to learn...difficult to realise this in the limited setting of the classroom."*
> *"Can view experiments generally not done in class."*
> *"The video clip can bring students out of the classroom."*

Moreover some teachers also indicated that IT could serve as a reminder to them in class.

> *"Helpful to me when teaching a subject I did not major in. There's lots of supplements and clear explanations."*
> *"The PPT reminds me of things I may have forgotten."*

6.3 Hindrances to Integration

The most frequently mentioned difficulty was the lack of time in preparation (five respondents). This coincides with the findings from the questionnaire survey: 69.9% of the respondents indicated that the lack of time was the biggest problem they encountered. Another major difficulty mentioned in the interview was the problem of access to the equipment.

The years ahead will only see heavier workloads for teachers brought about by the educational reforms. The use of IT can never mean a reduction of workload for teachers. Instead, it requires teachers to spend more time preparing for the lesson.

> *"You need much more than a lesson's time in preparing for a lesson's material...drawing, searching for information, reading books... A lot of time is needed."*
> *"In principle it saves time if it's used for many years...but the syllabus changes all the time..."*
> *"There're so many resources on the web but I can't use them directly. I need*

time to adapt them but it's often not enough."

"If I have time to learn more IT skills, I want to include animation in my lessons."

"...not enough time to prepare...the planning is so much more complicated than just a lesson of chalk and talk."

The government indeed needs to boost support for teachers if it is to encourage teachers to use IT. For example, more resources need to be developed for different subjects. It is impossible to ask teachers to develop materials all on their own given the time constraints. Teacher assistants should be employed to help teachers develop the resources or teaching materials using the computer. The teachers can generate the ideas while the assistant can materialise the ideas using his/her technical know-how and time.

One teacher from the interview actually exclaimed that he has to teach two groups of students, one using the CMI (Chinese as the medium of instruction) and the other using the EMI (English as the medium of instruction). Therefore he has to prepare materials which cater for two different groups of students. Moreover, most of the resources on the Web are in English and that makes it difficult for his students to access the Internet on their own. Considering that three quarters of the secondary schools in Hong Kong are CMI schools, this issue has to be addressed seriously.

The teacher's incentive to use the computer will be diminished if they find that the equipment is not available when they want to use it.

"You always have to carry the equipment to the classroom .The setting up is also very disturbing to students."

"Mainly the set up of the LCD takes time...maybe there are not enough notebooks to borrow."

Maddux (1998) has argued against the placement of all school computers in centralised labs. He uses the metaphor that if the use of pencils had been confined to the "pencil labs", the pencils would never have succeeded as an educational tool. Of course, the mere availability of hardware and software itself isn't sufficient to increase instructional use of computers, (Johnson, 1997; Ross, et al, 1999; Selwyn, 1997) at least it is an important prerequisite to successful incorporation of the technology in teaching.

6.4 Drawbacks of using IT

There is so much literature about the positive side of using IT but not the downside. A question on the drawbacks of using IT in the lesson was included in the interview schedule. These respondents were well aware of the pros and cons of using the computer.

One common view, reported by five respondents, about the drawbacks of the use of IT is that students get bored very easily without the stimulation of the images and sound because they are used to the appeal.

> *"Students are used to multimedia and diversity, when the teacher goes back to the textbook, they'll find it monotonous and boring.*
>
> *"Students are used to appealing PPT, animation and will easily get bored with non images, they can't easily focus on texts, reading, deep processing thinking etc."*

The implication is that with the increased use of the IT, teachers have the compulsion to make their lessons more and more stimulating and engaging to whet the students' appetite. This can be a beneficial effect on the quality of teaching. However, the respondents are also concerned about a more profound

ramification of the use of IT. Some teachers expressed the idea that IT is good for a start but it is for the students to explore the topic through his own reading, thinking, reflection and deep processing. For many students they just stop short at the initial stage and that makes their understanding of the topic superficial. Their being used to the visual and audio appeal makes it difficult for them to do serious reading and deep processing because all these mean effort and hard work which, sometimes is not as interesting.

> *"IT is good for initiation, quick and appealing, but the charts and images are superficial. Students need deeper processing in learning, reading skills to dig into issues, analytical power and a good power of expression."*
> *"Used to the environment at the click of a button, they can't easily focus on texts, reading, deep processing, thinking etc."*
> *"it affects their reading skills."*
> *"Used to graphics and sounds, don't like reading....as a result their concepts are superficial and not clear."*
> *"They think they understand the concept after browsing the samples of artworks on the screen but in fact without further reading their concept is not well-grounded."*

This is a very significant reminder to the user of IT in teaching that the use of the technology can never compromise important areas of learning like reading, writing, critical thinking skills, etc.

Three teachers also aired their concern that the pre-arranged materials could lower the flexibility of the teaching process and that the teaching progress could be slowed down.

> *"Difficult to amend the prepared materials in class"*
> *"Affects the teaching progress. Spend a lot of lesson time only achieving a small part"*

This again reflects the phenomenon that IT is mainly used for presentation in class. Thus contrary to the common belief that IT can promote interactivity and active participation in class, a language teacher made the following comment

about the use of IT in her lesson:

> *"Prepared materials have too much control on the teaching process and the sequence, it seems to assume that there's a package students have to learn... students become passive."*

> *"It's contrary to the spirit of language teaching which consists of small tasks, lots of interaction and even physical movements...so troublesome setting up the computer, so tend to use longer time for presentation."*

The computer subjects students to abundance of information but as expressed by a teacher, that can be a disadvantage if they do not have the skills to distinguish right and wrong information: "*the glut of information can be confusing for students*." So IT has the merit of exposing students to abundant, updated information but it is the teacher who makes students know how to analyse and make sense of the information. If we stop at the first part, our students will be at a loss in the face of the wealth of information.

Two respondents mentioned the breakdown of the computer as a drawback of using the computer.

> *"Not as secure as textbooks for the machine can break down. Too much reliance will affect the lesson."*
> *"Can waste half a lesson on a technical problem."*

The breakdown of the equipment is inevitable with the use of IT even for very experienced user. Thus the experienced teacher usually has back-up material for the lesson. If the technical support of the school is strengthened, that will encourage reluctant users to overcome their psychological barrier in using the computer.

6.5 Changes in the Role of the Teacher and the Student

Unlike the findings obtained in the quantitative data, in which nearly 90% of respondents remarked a change in the role of the teacher and the students, most respondents said there is not much or no change in the role of the teachers and that of the student. One said the role is changing because the teacher does not teach everything. Six teachers maintained that there was not much change as far as the roles are concerned.

The findings indicated that there is a discrepancy between what the teacher believed (as reflected in the questionnaire) and what they really experienced in their job (as indicated in the interview responses). They did not feel much of a change in the role of the teacher and that of the student in reality. Moreover it also reflects that the technology is still basically used as a tool for presentation during the lesson. One respondent said that there should be a change if the potential of IT is tapped to the full. He implied that the essence of IT in teaching has not materialised. The mode of teaching is therefore basically teacher-centred. There is not much difference from the traditional classroom in that the teacher acts as the presenter.

> *"It does facilitate information gathering but it is after all a medium, a vehicle like the textbook. It may be more active and updated but it is still up to the teacher to elaborate and analyse the topic."*
>
> *"Not much change, similar to before, only more diversified now in terms of teaching materials."*
>
> *"Not much change in the role; but can make students learn more actively, can access extra exercises on the server. There are more opportunities to learn."*
>
> *"Only a teaching aid, there's not much change in the role. In fact the use of IT in language learning is teacher-centred, incompatible with the current trend ---learner-based."*

The above findings are in agreement with the study by Wang (2001), who found that the student teachers used the computer significantly more as a teacher-centred tool than a student-centred tool. Johnson (1997) comments that the movement of the instructional process from teacher-directed to learner-centred learning is not an easy transition. Perhaps the secondary school teachers in Hong Kong are still in the long, slowly-evolving transitional stage of this shift.

6.6 IT and the Subject taught

6.6.1 Types of Applications used

According to the questionnaire survey, the most frequently used applications were PowerPoint (71.3%) and Web browsing (44.6%). In the interview schedule, questions were asked to probe the way teachers used IT in the subjects they taught. The findings from the interview were in line with the result from the questionnaire survey. PowerPoint, followed by Web Browsing, was the most often used application.

6.6.2 Views of Computer Applications used

The way IT was used in the classroom did have a strong impact on the teachers' view of the technology. When the respondents were asked to give successful examples of using IT in the lessons, their examples illustrated the advantages of using PowerPoint in presenting their teaching points. For instance, it makes the lesson more appealing by enabling the use of multimedia materials:

> *"Good for teaching grammar... students like the attractive pictures. (English lessons)*
>
> *"Show the songs of the age and conversation excerpts of the important figures. Arouse motivation. (Chinese History lesson)*
>
> *"More interesting to show students the map and comic strips than just*

talk."(a lesson on WWI---Treaty of Versailles)

"show students a film strip about the life of the mathematician to arouse their interest."

"Film also shows concrete evidence to prove the theory, good supplements ...don't have enough time, space and the tools necessary to prove the theory in the classroom." (lessons on Pythagorus Theorem)

The presentation is made more concrete and interesting with the inclusion of pictures, comic strips, filmstrips, songs, etc.

Another thing made possible by the use of IT illustrated in their examples is the fact that it resolves the constraints of the classroom setting.

"The CD-ROM clearly illustrates the interesting aspects with games: the order of brush strokes, the development and the pronunciation of characters."

The classroom setting may not be appropriate for the use of Chinese brush and ink and the calligraphy itself, let alone demonstrating the writing process clearly to a class of forty or more. On the contrary, the film strip allows close-ups, replays, slow motions etc, which would bring to life the writing process to each student.

"Film also shows concrete evidence to prove the theory, good supplements ...don't have enough time, space and the tools necessary to prove the theory in the classroom."

When teaching Pythagorus Theorem, the teacher made use of the film to demonstrate to students the different strands of evidence in proving the theorem while in the classroom it is implausible to include all the proof because of the lack of time, space and more importantly, equipment to do so.

Installation artworks are usually enormous in size and are often dismantled after

being displayed for some time. In this case, the teacher photographed different samples of installation artworks and showed them to the students in class. Hence the students could have a clear idea of what installation art is.

> *"Installation artworks are usually too big for the classroom and non-durable, so can't take students to the location"*

6.6.3 Subject –Specific Constraints

An attempt was made to investigate the relationship between the subject taught and the difficulty in using IT. For basically all subjects, the teachers explained that they just lacked time to prepare for the materials even though there may be a lot of resources on the Web. Time seems to be the universal main constraint: *"found lots of information about a figure...but has to spend a lot of time editing."* The language issue seems to add to the difficulty. *"Information on the Net is usually in English, of a level too difficult for our students.*

6.6.4 Subject Taught and the Frequency of Use

As indicated by the questionnaire survey, IT is more readily used in science and social science subjects than the others. It may be attributed to differential availability of resources from the Net or the publishers. The interview results seem to indicate that the amounts of resources for subjects differed both from the Web and from the publishers. Further inquiries are needed to explore the area.

> *"Unlike Biology, Geography which are world-wide subjects, the subject is mostly confined to Chinese communities. Resources are developed much later than other countries"* (Chinese language)
>
> *"difficult to find pictures, songs or information from the Web except for modern history." "not many resources, only one relatively good set developed with QE fund (Chinese History)*
>
> *"Many abstract concepts can be found on the websites. It's amazing." "The publishers also provide rich materials & CD-ROMs." (Physics)*

Moreover, the subject nature could affect the frequency of use. For example, the English teachers exclaimed that the use of IT has reduced the lesson to one of presentation and has taken away much of the interaction time.

> *"IT serves to present ideas clearly but it doesn't contribute to practice and interaction which is vital to language learning"*
>
> *"IT plays only a small part in language teaching."*

Of course IT is purely used in the English lesson in the form of PowerPoint and this will make language teaching teacher-centred rather than student-centred. Thus to the language teacher, IT only plays a minor role.

Another illustration of the relationship between subject nature and the use of the technology was exemplified in the case of PE lessons. A PE teacher mentioned that he only used IT once in a while during the P.E. lessons, for example, on rainy days because the teacher *"... won't take the trouble to set up equipment in the playground just for a 5 min film strip."* Students do not accept the idea that they just sit and watch. They think they come to the P.E. lesson to play. Thus a P.E. teacher hammered home the message:

> *"Students, parents need to change the concept about PE lessons. They don't just come to play... need to learn to appreciate and evaluate. They can appreciate the skills of a basketball player and learn from him... students' performance can also be videotaped and shown for peer assessment and IT does facilitate that."*

Therefore, the more efficient use of IT should in many ways couple with a change in the approach of teaching and the nature of the curriculum.

6.6.5 Recommendations

The respondents were asked about the ways to enhance better integration of the technology into the subject they taught, most teachers expressed the need to

improve on the interactivity of the software. It implies that the teachers were not only content with using the PPT as a more appealing presentational tool when teaching, they also believed that the merits of IT can be better and further harnessed by exploring the nature of interactivity of the technology.

> *"students can play the role of the king in the software and decide on the course of action to take; hence, more participation, more thinking."*
>
> *"Not just web- browsing and PPT, more interactive materials are needed"*
>
> *"Not just web browsing, IH stresses students' self-learning approach... should include more interactive elements."*
>
> *"More interactive materials are needed; now it's only for presentation"*

Besides, another major suggestion of the respondents was that there was a need for more tailor-made resources. Considering time constraint as the greatest difficulty, this suggestion should be seriously addressed. This also echoes the views of the interviewees of Yaghi and Ghaith's study (2002) that there is a lack of educational software that is really effective in teaching various topics in subject matter areas. The software is of non-native language, irrelevant and does not meet the curriculum requirements. Hinostroza and Mellar comment that there is a lack of consideration of teachers' actual classroom practices during the software design process. They argue for a necessity of having "a more situated view of software design" (2000:198). The design of educational software should be based on an understanding of what is happening in the classroom. More effective resources should be developed by publishers, educational software companies and the EMB, paying particular attention to the interactivity of the software. These people should understand the instructional context when designing the software. On the other hand the government can increase the technical support for schools so that there are assistants helping teachers develop resources custom-made for their needs. Moreover there is a good mechanism to

ensure that these teaching materials can be shared among teachers of all schools.

6.7 IT Policy in Hong Kong

In recent years the IT policy has been launched with so much pomp. Teachers were required to receive IT training and to meet the requirements of Basic Information Technology (BIT), Intermediate Information Technology (IIT) etc. Computers were poured into schools and huge funds were granted for the installation of the multi-media learning centres in schools. IT coordinators have been dispatched to schools to render support. The fanfare seems to have died down in the past year or so. A question was included in the interview schedule to gauge the teachers' opinion on the IT policy of the EMB.

Their opinions can be summarised in four aspects:

First, teachers in general believed that it is good for teachers to know some basic skills in the computer, and so the mandatory BIT and IIT training was welcomed. Many said that it was good that teachers had some basic IT skills but only one teacher expressed the need for follow-up training. The others did not explicitly say that that they wanted further training on IT. This could be encapsulated by the utterance of one teacher, "there was some training but teachers were too busy."

Second, teachers in general are not so keen on receiving more training as receiving more technical support and resources as one teacher remarked:

> *"It's enough to have basic skills, not every teacher has to know sophisticated skills. Teachers don't need to learn technical skills which are not required in their actual teaching."*

On the other hand, they did argue that the government ought to inject money in

developing more resources and rendering technical support.

> *"Not enough support from EMB. Support to produce teaching materials/resources needed...can benefit all schools through sharing."*
> *"Government should spend more on both software and hardware, not just the latter."*
> *"More money should be spent on the school licences for software, e.g. Photoshop, Illustrator, Freehand, etc."*
> *"More resources should be provided. Teachers have no time to produce resources which cater for students of different standards and languages of instruction. There should be more variety and more choices."*
> *"There should be people to develop resources. The government must give technical support and IT knowledge and not just invest in hardware."*

Third, the teachers believe in the pros of IT but they regard that the importance of IT should not be overrated. They think that:

> *"IT is only a useful tool and teachers can do well without it."*
> *"Don't deify IT, only a tool like OHP. Teacher's ability is not embodied in IT ability. There should be no superstition in IT."*
> *"Don't deify IT, only a tool like OHP" "Students need to have the ability to learn. Students may appreciate the attractive images but not learn the content."*
> *"The question is to put more resources on how to help students learn better rather than investing too much on hardware."*
> *"The government should not force teachers to use IT...not every teacher has to use IT. Different teachers have different styles."*
> *"Teachers can teach well without IT."*

Lastly, the respondents believe there is much room for further exploring the use of IT in teaching.

> *"The use of IT consists in far more than just a dynamic book; there should be development and exploration in a deeper and broader sense."*
> *"Discussion seems to have faded out after a couple of years. School-based or subject-based discussion on the use of IT is not enough."*

Overall speaking, the frequent users of IT appear to conceptualise the potential

and the limitations of the technology but hardware and software often get used in limited ways to simply maintain rather than transform prevailing instructional practices in Hong Kong secondary schools. The respondents, who themselves are frequent users of IT, basically adapted an innovation to fit their customary practices, not revolutionise them. The hard sell fashion adopted by the government when it first pushed forward the IT Policy explains why some teachers warned against deifying the technology. At present, the initial fanfare of the campaign has died down, the IT requirements have been fulfilled, the mandatory training has been taken, and discussion about the use of IT in teaching has faded (as reflected by one of the respondents). The metamorphosis may be an extraordinarily slow process to complete at best. At worst, the transformation may not come through at all because it relies only on the incidental use of the serious users rather than a systematic implementation plan involving all the administrators and teachers.

6.8 Chapter Summary

In line with the findings from the quantitative survey, the interviewees feel strongly about the technology's contribution to effectiveness of teaching through the use of multimedia materials and more efficient management of the teaching materials. Interestingly, their views about the advantages of using the computer reflect the restrictive use of the technology. It is still predominantly used as a presentation tool in class.

This ties in with the teachers' perception about the role of the teachers and the students. Most of them believe that there is basically no change or little change involved. This further lends support to the conclusion that the instructional use of

IT is confined to the mode of presentation at this stage, which has left little room for a student–centred classroom.

Thus in the teachers' recount of their use of the technology in their subjects, they also lament the lack of teaching software and resources which are truly interactive. They anticipate IT's bringing in a more revolutionary change in the dynamics of the classroom. Thus they are relying on the technology to bring about change even though the evidence of research so far suggests it is the teacher who must do this.

On the one hand, the interview does help to verify the findings previously collected. On the other, it further sheds light on the teachers' perceptions about a couple of other issues not covered in the questionnaire---their beliefs about the drawbacks of using IT in their class and their general opinions about the government's IT Policy. Serious users of IT as the respondents are, they do warn us against the over-reliance on the technology. For instance, they are concerned that computer technology could indulge students' desire for sensuous appeal and may not be able to induce them to proceed with in-depth pursuit for knowledge. They believe technology should never compromise important areas of learning.

Thus teachers in general believe in the value of using IT in the lessons, but they caution against the over-estimation of the importance of information technology. On the other hand, the potential of the technology, they believe, has not been tapped to the full for use in the classroom. Further development and discussion on the effective integration of IT with teaching among the educators should not fade with the initial fanfare attached to the inception of the IT Policy.

Chapter 7 Conclusion

The first area of my study was secondary school teachers' computer attitudes and usage. Interesting findings were yielded in the relationship between the subject taught and the computer attitudes and computer use in class. Language teachers were found to have less positive attitudes towards the computers and their use of computers was also the least frequent. On the other hand, science teachers demonstrated a positive attitude towards the computers and a high usage rate. Interestingly, though social science teachers harboured a less positive attitude towards the computers, they exhibited a surprisingly high rate of usage, comparable to that of the science teachers. Thus, it seems the relationship between these variables; attitude, subject and usage rate may not be straightforward.

Many factors are at work influencing the use of computers in class apart from the computer attitudes. In fact, the correlation between computer attitudes and use of computers in class was not a strong one: .21 for computer anxiety, .33 for computer confidence and .30 for computer liking according to the finding in the survey analysis. The interview findings have further shed light on this area. The amount of resources available, the appropriateness of the software, the subject nature, the types of applications used, the current mode of computer use in class, the degree of affiliation of the subject categories with computers, etc. all play a role in explaining the differential use of the computer in class by different subject teachers.

A lot more studies have been conducted on how gender and age affect computer attitudes and computer use in class (Jennings & Onwuegbuzie, 2001; Mitra, LaFrance, & McCullough, 2001; Shashaani, 1993; Todman & File,1993) but the influence of the subject taught by the teacher has not been fully examined. This is an

area which warrants further inquiries. Results could give rise to more pragmatic implications for subject-specific training and software development.

Findings of the present study have revealed that attitude is a predictor of computer use but not a strong one. Many previous studies have focussed on the importance of enhancing the teachers' computer attitudes. While improving teachers' confidence in computers is important, other factors have to be considered. To effect instructional use of the computer, the teachers should be able to see that IT is of great use to them. The social science teachers had less positive computer attitudes but their usage rate was high. They may not like computers, but they use them. Web Browsing is a very important ingredient in teaching these subjects. It seems, provided that the software and resources are appropriate and available, teachers will be more willing to use IT. On the other hand, the overall policy and support of the school, the effectiveness of the IT training provided, the ethos of collegial sharing, the receptiveness of the teachers to change, etc. all influence the readiness of the teacher to use the technology in the lesson.

The second focus of my study is how teachers use IT in their teaching. According to the quantitative results, the most frequently used application is PowerPoint, followed by Web Browsing and Word Processing. This was confirmed by the findings in the interview survey. Moreover according to the survey, science teachers seemed to use a wider variety of applications while language teachers and social science teachers' use of IT was narrower in scope.

We can see that the use of IT in the lessons may be subject-based and there is no need to push every teacher to use the same amount or type of IT in their lessons.

Some subjects appear to capitalize on the technology better than the others because it is more relevant. More research needs to be done on this.

More food for thought is that the current mode of using the technology lacks interactivity, which should be one major attraction of incorporating computers in class (Davis, et al, 1997; Taylor, 1980). Therefore when interviewed, most of the teachers expressed that there should be development of more software, which should also be truly interactive to increase students' participation.

Thus despite the overall high usage rate of IT in the classroom (70%), it seems the merits of the technology have not been fully tapped. The use is still restricted and confined. Apparently, up to this stage, IT has been used to maintain the teachers' pedagogical trend rather than initiate a revolutionary change in instruction. Thus, more has to be done to explore the use of IT in teaching to the full.

The third focus of my study is about the teachers' opinions about the computer in teaching. The teachers' major difficulty in the use of the computer is the lack of time. Many teachers expressed the idea that their workload was so heavy that they did not often have time to browse the web and adapt materials for their use in lessons. They might as well use the existing materials. For those who used IT in their teaching often relied on the PowerPoint or filmstrips produced by the publishers.

The teachers' beliefs about the advantages of using the technology were positive. More effective lessons and more efficient management of the teaching materials were the two main benefits perceived by the teachers. These were the main incentives in enticing the teachers to use IT. It is noticeable, however, that only a

minority of respondents, pinpointed advantages that underpin a student-centred classroom.

As far as the roles of the teachers or the students are concerned, most interviewees believed that there was not much change. The findings on the teachers' beliefs about the roles and the advantages of using IT have further thrown light on the way IT is currently used. They lend support to the fact that IT has not been used to effect a drastic change in the way of teaching. Rather it is used as a tool to maintain the teachers' current teaching practice. Therefore if teachers are to better harness the computer to conduct effective teaching rather than use it as an alternative to chalk and OHP, more discussions need to be done and support given. Without them, the use of IT may finally discontinue with most teachers. Those who continue will find it hard to break new ground.

Literature has not referred so much to the downsides of using IT. Hence, the interview schedule included a question about the drawbacks of the use of computers in class. The respondents, though assured of the importance of IT in teaching, believed that it should not be deified. It should only be considered a different tool in the new millenium. There could be defects in the over-reliance on the technology. They realized that the students could become addicted to the appeal of graphics and sounds, the sensational pleasure and become more difficult to "please". More importantly, IT cannot be a replacement for deep processing and careful, analytic reading. The lure of the images and sounds will make it more difficult for students to focus on words patiently. Therefore IT should only be used for initiation. The students need to proceed further into the core of the bulb. Furthermore, students are exposed to a glut of information on the Internet and they could be at a loss in the face

of the wealth of information. They need to possess the wisdom to discern the valid from the junk, learn how to select, conclude from and organise the information for their own use. This does not come naturally. The teachers have a more important role in helping them develop those critical skills.

Maddux, Johnson and Willis (2001:2) express this clearly: "After all, the computer is a tool, and, like any tool, it can be poorly used or misused." The potential and shortcomings of the technology have to be appreciated in order that it can be appropriately used to enhance teaching and learning.

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Appendices

Appendix 1
Survey Questionnaire

Dear fellow teacher,

I am a student of the Doctor of Education Programme of Bristol University and I am carrying out a research study about secondary school teachers' use of information technology (IT) in Hong Kong. I hope to collect data on three specific areas:

a) secondary school teachers' general attitudes towards the use of computers
b) the way they integrate IT into teaching and
c) their opinions about the integration of IT into teaching

I hope the research findings will inform policy-makers both about the benefits and pitfalls of the IT initiative and about ways to resolve problems arising. I sincerely wish that you could spare ten minutes or so to complete the questionnaire attached and return it to me using the self-addressed envelope before April 2002. You may also give it to me through

Please be assured that the information you give will be kept confidential. You can also reach me on 98041024 for enquiries. I fully understand how busy you could be at this time of the year. I very much appreciate your help and kindness and will send you a copy of my data analysis results for your reference.

Yours sincerely,

Mandy Mak
A secondary school teacher

Please kindly complete *all* the questions below about secondary school teachers' use of information technology in Hong Kong. All the information you give will be kept confidential. Thank you very much.

以下問卷是有關香港中學教師對資訊科技的運用。請回答*所有*問題，所填資料絕對保密，謝謝你的合作。

1. Sex Male ❑ (1) Female ❑ (2)

2. Age Group

28 or below ❑ (1) 29-34 ❑ (2) 35-40 ❑(3) 41-46 ❑(4) 47-52 ❑(5)

53+❑ (6)

3. Subject(s) taught

Subject taught	No. of lessons per week/cycle
1.	
2.	
3.	

4. Years of teaching experience

5 years or below ❑(1) 6-10 years ❑ (2) 11-15 years ❑ (3) 16-20years ❑ (4)

20years+❑(5)

5. The following is a set of statements about attitudes to the computer.

For each statement, please say whether you

(SA) strongly agree (1),

(A) agree (2)

(N) are neutral (3)

(D) disagree (4) or

(SD) strongly disagree (5) with it.

Tick the appropriate box.

	SA	A	N	D	SD
1. Computers do not scare me at all. 電腦完全嚇不倒我。					
2. Working with a computer would make me very nervous. 用電腦工作令我很緊張。					
3. I do not feel threatened when others talk about computers. 別人談論使用電腦時，我不覺得受威脅。					
4. I feel aggressive and hostile towards computers. 我對電腦極反感。					
5. It wouldn't bother me at all to take computer courses. 參加電腦班不會使我苦惱。					

	SA	A	N	D	SD
6. Computers make me feel uncomfortable. 電腦令我很不自在。					
7. I would feel at ease in a computer class. 參加電腦班的時候，我感到很自然。					
8. I get a sinking feeling when I think of trying to use a computer. 當我想到用電腦時，便有點情緒低落。					
9. I would feel comfortable working with a computer. 用電腦工作時，我感到很愜意。					
10. Computers make me feel uneasy and confused. 電腦令我困惑不安。					
11. I'm no good with computers. 我的電腦技術不靈光。					
12. Generally I would feel OK about trying a new problem on the computer. 要在電腦上嘗試新挑戰，我通常沒感到有大問題。					
13. I don't think I would do advanced computer work. 我想我不會用電腦做複雜的工作。					
14. I am sure I could work with computers. 我肯定我能用電腦工作。					
15. I'm not the type to do well with computers. 我　是善於使用電腦的人。					
16. I am sure I could learn a computer language. 我肯定我能掌握電腦語言。					
17. I think using a computer would be very hard for me. 我覺得用電腦對我是很困難的事。					
18. I could get good grades in computer courses. 在電腦課程，我會取得好成績。					
19. I do not think I could handle a computer course. 我想我不能應付電腦課程。					
20. I have a lot of self-confidence when it comes to working with computers. 當用電腦工作時，我很有自信。					
21. I would like working with computers. 我樂意用電腦工作。					
22. The challenge of solving problems with computers does not appeal to me. 用電腦解決問題這個挑戰，對我並不吸引。					
23. I think working with computers would be enjoyable and stimulating. 我相信用電腦工作是一種享受，也會令人興奮。					
24. Figuring out computer problems does not appeal to me. 處理電腦問題，對我實不吸引。					
25. When there is a problem with a computer run that I can't immediately solve, I would stick with it until I have the answer. 使用電腦時如遇上困難，我會堅持不懈，直至找到答案。					

	SA	A	N	D	SD
26. I don't understand how some people can spend so much time working with computers and seem to enjoy it. 我不明白爲何有些人可以花那麼多時間在電腦上，仍然覺得是一種樂趣。					
27. Once I start to work with the computer, I would find it hard to stop. 我一旦開始用電腦工作，便很難停下來。					
28. I would do as little work with computers as possible. 我盡可能少用電腦處理工作。					
29. If a problem is left unsolved in a computer class, I would continue to think about it afterward. 在電腦班上遇上未能解決的難題，我會在課後繼續思量。					
30. I do not enjoy talking with others about computers. 我不喜歡與人談論電腦。					

6. What are your major difficulties in integrating IT into teaching? (Pls write 1, 2, 3 etc. to rank the degree of difficulty)

請用 1,2,3 等數字排列你在教學上融合資訊科技的困難。(1 是最困難，如此類推。)

___I don't have time preparing IT for my lessons. (1)

___I don't know how to integrate IT into the subject I teach. (2)

___I don't have enough training in IT and assistance from school. (3)

___I am afraid of making mistakes in the classroom which I cannot handle(4)

___Others (Pls specify) (5) _____

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7. In your opinion, what are the benefits of integrating IT into teaching?

於教學上融合資訊科技，你認爲有何益處？

_____

_____

_____

_____

_____

8. How does the use of IT in the classroom change the role of students and that of teachers ?

在課堂上，資訊科技如何改變學生和老師的角色？(例如：老師不是主要的知識傳授者...)

_____

_____

_____

_____

9. **How often do you use IT in the subject you teach?**

Every day ❑(1) every 2-3 days ❑(2) weekly ❑(3) every 2 weeks ❑(4)
monthly ❑(5) seldom ❑(6)

10. **How do you use IT in your teaching?**

Please select the two or three most frequent activities in your class.

a) Web browsing 瀏覽網頁	**h) web design** 網頁
b) Simulation 模擬	**i) drawing and graphics** 電腦繪圖設計
c) spreadsheets 電子數據表	**j) email/ICQ** 電郵 / ICQ
d) Database Design 數據庫設計	**k) programming languages** 程式語言
e) microcomputer based laboratories 電腦實驗室	**l) drill and practice software** 反覆練習軟件
f) word processing 文字處理	**m) others (please specify)** 其他(請註明)
g) PowerPoint Presentation 簡報	

e.g. Subject/paper:_____ activity:_____

Subject/paper:_____ activity:_____

Subject/paper:_____ activity:_____

Subject/paper:_____ activity:_____

Thank you very much for your help. Goodbye!

Appendix II

Interview schedule

謝謝你願意接受我的訪問，這次訪問的目的是要了解前線老師使用 IT 教學的情況。
在訪問過程中，我可以錄音和做筆記嗎？
今次訪問所得的資料只作研究用途，一切資料將會保密。

1. 今年你主要任教哪些科目？

2. 請你分享把 IT 融入教學的主要原因。

3. 在你的經驗中，使用 IT 對你和對學生有甚麼好處？

---

4. 對你來說，用 IT 教學有困難嗎？ / 可否分享你的成功之道？

5. 有沒有困難是跟你所任教的科目有關呢？若有，是哪些困難呢？

6. 你怎樣克服這些困難？

7. 你認爲用 IT 教學有沒有改變你和學生的角色？有甚麼改變？

8. 你對這些角色的轉變有甚麼感受？(例如：恐懼、愉快...等)

9. 你認用 IT 教學有甚麼弊病？可以舉一些實際例子嗎？

10.在你的教學過程中，怎樣應用電腦？

11.你使用 IT，通常爲了達到甚麼的教學效果 / 目的？(例如：引起動機、溫習、介紹新的概念、鞏固所學...)

12.你可以具體地舉一些使用 IT 成功達到教學目的的例子嗎？

13.你認爲怎樣才可以更有效把 IT 融入你的科目中？可以做些甚麼呢？

14.你對香港的 IT 教學政策有甚麼意見？

Interview schedule (an English translation)

Thank you for agreeing to be interviewed. The purpose of this interview is to probe the secondary school teachers' use of IT in teaching.
Would you mind my tape-recording the interview and taking notes during the process?
The data collected from the interview are for the purpose of research and they will be kept in strict confidence.

1. What subjects do you teach this year?

2. What is the main reason why you use IT in your teaching.

3. From your experience, how have you benefited from the use of IT in your

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4. Do you have difficulties integrating IT in teaching? (If not, can you share your successful experiences.)

5. Are there difficulties specifically related to the subject(s) you teach?

6. How have you tried to overcome these difficulties?

7. Do you think using IT in teaching changes your role or your student's role? (If yes, can you this change?)

8. How do you feel about these changes? (e.g. pleased, threatened?)

9. In your opinion, are there drawbacks in using IT in teaching? (Can you give some practical examples?)

10. What computer applications do you often use in your teaching?

11. For what purposes do you use IT? (e.g. motivating, reviewing, presenting new ideas, consolidating, etc?)

12. Please give specific examples of how you've used the application(s) successfully in your subject.

13. What can be done to effect better integration of IT in your subject?

14. What are your general opinions of the IT policy of the Education and Manpower Bureau?

Appendix III

Multiple Comparisons of the computer attitudes of teachers teaching different main subject categories

Multiple Comparisons

Bonferroni

Dependent Variable	(I) categora	(J) categora	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
CANXIETY	languages	social sciences	.78	1.27	1.00	-2.82	4.39
		sciences	-4.23*	1.02	.00	-7.12	-1.34
		cultural subjects	-2.09	1.59	1.00	-6.61	2.43
		others	-.69	2.15	1.00	-6.78	5.40
	social sciences	languages	-.78	1.27	1.00	-4.39	2.82
		sciences	-5.01*	1.32	.00	-8.74	-1.28
		cultural subjects	-2.87	1.80	1.00	-7.97	2.22
		others	-1.47	2.30	1.00	-8.00	5.06
	sciences	languages	4.23*	1.02	.00	1.34	7.12
		social sciences	5.01*	1.32	.00	1.28	8.74
		cultural subjects	2.14	1.63	1.00	-2.48	6.76
		others	3.54	2.18	1.00	-2.63	9.71
	cultural subjects	languages	2.09	1.59	.00	-2.43	6.61
		social sciences	2.87	1.80	1.00	-2.22	7.97
		sciences	-2.14	1.63	1.00	-6.76	2.48
		others	1.40	2.50	1.00	-5.68	8.48
	others	languages	.69	2.15	.00	-5.40	6.78
		social sciences	1.47	2.30	1.00	-5.06	8.00
		sciences	-3.54	2.18	1.00	-9.71	2.63
		cultural subjects	-1.40	2.50	.00	-8.48	5.68
CCONFIDE	languages	social sciences	9.44E-02	1.38	.00	-3.81	4.00
		sciences	-5.20*	1.10	1.00	-8.33	-2.07
		cultural subjects	-3.38	1.73	.51	-8.28	1.51
		others	-2.63	2.33	1.00	-9.23	3.96
	social sciences	languages	-9.44E-02	1.38	1.00	-4.00	3.81
		sciences	-5.29*	1.42	.00	-9.33	-1.25
		cultural subjects	-3.48	1.95	.75	-9.00	2.04
		others	-2.73	2.49	1.00	-9.80	4.35
	sciences	languages	5.20*	1.10	.00	2.07	8.33
		social sciences	5.29*	1.42	.00	1.25	9.33
		cultural subjects	1.81	1.76	1.00	-3.19	6.82
		others	2.56	2.36	1.00	-4.11	9.24
	cultural subjects	languages	3.38	1.73	.51	-1.51	8.28
		social sciences	3.48	1.95	.75	-2.04	9.00
		sciences	-1.81	1.76	1.00	-6.82	3.19
		others	.75	2.70	1.00	-6.91	8.41
	others	languages	2.63	2.33	1.00	-3.96	9.23
		social sciences	2.73	2.49	1.00	-4.35	9.80
		sciences	-2.56	2.36	1.00	-9.24	4.11
		cultural subjects	-.75	2.70	1.00	-8.41	6.91
CLIKING	languages	social sciences	5.00E-02	1.19	1.00	-3.31	3.41
		sciences	-2.78*	.95	.04	-5.48	-8.94E-02
		cultural subjects	-2.13	1.49	1.00	-6.34	2.08
		others	-2.38	2.00	1.00	-8.06	3.30
	social sciences	languages	-5.00E-02	1.19	1.00	-3.41	3.31
		sciences	-2.83	1.23	.22	-6.31	.64
		cultural subjects	-2.18	1.68	1.00	-6.93	2.57
		others	-2.43	2.15	1.00	-8.52	3.66
	sciences	languages	2.78*	.95	.04	8.94E-02	5.48
		social sciences	2.83	1.23	.22	-.64	6.31
		cultural subjects	.66	1.52	1.00	-3.65	4.96
		others	.41	2.03	1.00	-5.34	6.16
	cultural subjects	languages	2.13	1.49	1.00	-2.08	6.34
		social sciences	2.18	1.68	1.00	-2.57	6.93
		sciences	-.66	1.52	1.00	-4.96	3.65
		others	-.25	2.33	1.00	-6.85	6.35
	others	languages	2.38	2.00	1.00	-3.30	8.06
		social sciences	2.43	2.15	1.00	-3.66	8.52
		sciences	-.41	2.03	1.00	-6.16	5.34
		cultural subjects	.25	2.33	1.00	-6.35	6.85

*. The mean difference is significant at the .05 level.

Appendix IV Mutilpe comparisons of the computer attitudes of different schools

Bonferroni

Dependent Variable	(I) Name of school	(J) Name of school	Mean Difference (I-J)	Std. Error	Sig.
computer anxiety	A	B	2.68	2.03	1.00
		C	-.74	1.77	1.00
		D	5.06	2.24	1.00
		E	1.69	3.20	1.00
		F	5.89	1.97	.21
		G	-.40	1.90	1.00
		H	2.05	1.62	1.00
		I	2.37	2.24	1.00
		J	.43	2.80	1.00
		K	-2.01	2.45	1.00
		L	2.16	2.15	1.00
	B	A	-2.68	2.03	1.00
		C	-3.42	1.93	1.00
		D	2.38	2.37	1.00
		E	-.99	3.29	1.00
		F	3.21	2.12	1.00
		G	-3.08	2.05	1.00
		H	-.63	1.80	1.00
		I	-.31	2.37	1.00
		J	-2.25	2.90	1.00
		K	-4.69	2.57	1.00
		L	-.52	2.28	1.00
	C	A	.74	1.77	1.00
		B	3.42	1.93	1.00
		D	5.80	2.15	.50
		E	2.43	3.14	1.00
		F	6.63*	1.87	.03
		G	.34	1.79	1.00
		H	2.79	1.50	1.00
		I	3.11	2.15	1.00
		J	1.18	2.73	1.00
		K	-1.27	2.37	1.00
		L	2.90	2.05	1.00
	D	A	-5.06	2.24	1.00
		B	-2.38	2.37	1.00
		C	-5.80	2.15	.50
		E	-3.37	3.43	1.00
		F	.83	2.32	1.00
		G	-5.46	2.26	1.00
		H	-3.01	2.03	1.00
		I	-2.69	2.56	1.00
		J	-4.63	3.06	1.00
		K	-7.07	2.74	.70
		L	-2.90	2.47	1.00

Appendix IV Mutilpe comparisons of the computer attitudes of different schools

Bonferroni

Dependent Variable	(I) Name of school	(J) Name of school	Mean Difference (I-J)	Std. Error	Sig.
computer anxiety	E	A	-1.69	3.20	1.00
		B	.99	3.29	1.00
		C	-2.43	3.14	1.00
		D	3.37	3.43	1.00
		F	4.20	3.26	1.00
		G	-2.10	3.22	1.00
		H	.36	3.06	1.00
		I	.68	3.43	1.00
		J	-1.26	3.82	1.00
		K	-3.70	3.57	1.00
		L	.47	3.37	1.00
	F	A	-5.89	1.97	.21
		B	-3.21	2.12	1.00
		C	-6.63*	1.87	.03
		D	-.83	2.32	1.00
		E	-4.20	3.26	1.00
		G	-6.30	1.99	.12
		H	-3.84	1.73	1.00
		I	-3.52	2.32	1.00
		J	-5.46	2.86	1.00
		K	-7.90	2.52	.13
		L	-3.73	2.23	1.00
	G	A	.40	1.90	1.00
		B	3.08	2.05	1.00
		C	-.34	1.79	1.00
		D	5.46	2.26	1.00
		E	2.10	3.22	1.00
		F	6.30	1.99	.12
		H	2.45	1.65	1.00
		I	2.77	2.26	1.00
		J	.84	2.81	1.00
		K	-1.60	2.47	1.00
		L	2.56	2.16	1.00
	H	A	-2.05	1.62	1.00
		B	.63	1.80	1.00
		C	-2.79	1.50	1.00
		D	3.01	2.03	1.00
		E	-.36	3.06	1.00
		F	3.84	1.73	1.00
		G	-2.45	1.65	1.00
		I	.32	2.03	1.00
		J	-1.61	2.63	1.00
		K	-4.06	2.26	1.00
		L	.11	1.92	1.00

Appendix IV Mutilpe comparisons of the computer attitudes of different schools

Bonferroni

Dependent Variable	(I) Name of school	(J) Name of school	Mean Difference (I-J)	Std. Error	Sig.
computer anxiety	I	A	-2.37	2.24	1.00
		B	.31	2.37	1.00
		C	-3.11	2.15	1.00
		D	2.69	2.56	1.00
		E	-.68	3.43	1.00
		F	3.52	2.32	1.00
		G	-2.77	2.26	1.00
		H	-.32	2.03	1.00
		J	-1.93	3.06	1.00
		K	-4.38	2.74	1.00
		L	-.21	2.47	1.00
	J	A	-.43	2.80	1.00
		B	2.25	2.90	1.00
		C	-1.18	2.73	1.00
		D	4.63	3.06	1.00
		E	1.26	3.82	1.00
		F	5.46	2.86	1.00
		G	-.84	2.81	1.00
		H	1.61	2.63	1.00
		I	1.93	3.06	1.00
		K	-2.44	3.21	1.00
		L	1.72	2.98	1.00
	K	A	2.01	2.45	1.00
		B	4.69	2.57	1.00
		C	1.27	2.37	1.00
		D	7.07	2.74	.70
		E	3.70	3.57	1.00
		F	7.90	2.52	.13
		G	1.60	2.47	1.00
		H	4.06	2.26	1.00
		I	4.38	2.74	1.00
		J	2.44	3.21	1.00
		L	4.17	2.66	1.00
	L	A	-2.16	2.15	1.00
		B	.52	2.28	1.00
		C	-2.90	2.05	1.00
		D	2.90	2.47	1.00
		E	-.47	3.37	1.00
		F	3.73	2.23	1.00
		G	-2.56	2.16	1.00
		H	-.11	1.92	1.00
		I	.21	2.47	1.00
		J	-1.72	2.98	1.00
		K	-4.17	2.66	1.00

Appendix IV Mutilpe comparisons of the computer attitudes of different schools

Bonferroni

Dependent Variable	(I) Name of school	(J) Name of school	Mean Difference (I-J)	Std. Error	Sig.
computer confidence	A	B	.99	2.29	1.00
		C	-2.23	1.99	1.00
		D	1.55	2.52	1.00
		E	1.91	3.60	1.00
		F	3.46	2.22	1.00
		G	-.68	2.14	1.00
		H	-.19	1.83	1.00
		I	2.17	2.52	1.00
		J	-.86	3.15	1.00
		K	-1.09	2.76	1.00
		L	-.69	2.41	1.00
	B	A	-.99	2.29	1.00
		C	-3.21	2.17	1.00
		D	.57	2.67	1.00
		E	.92	3.71	1.00
		F	2.47	2.38	1.00
		G	-1.67	2.31	1.00
		H	-1.18	2.02	1.00
		I	1.18	2.67	1.00
		J	-1.85	3.26	1.00
		K	-2.08	2.89	1.00
		L	-1.68	2.56	1.00
	C	A	2.23	1.99	1.00
		B	3.21	2.17	1.00
		D	3.78	2.42	1.00
		E	4.14	3.53	1.00
		F	5.69	2.10	.49
		G	1.54	2.02	1.00
		H	2.04	1.68	1.00
		I	4.40	2.42	1.00
		J	1.36	3.07	1.00
		K	1.14	2.67	1.00
		L	1.54	2.31	1.00
	D	A	-1.55	2.52	1.00
		B	-.57	2.67	1.00
		C	-3.78	2.42	1.00
		E	.35	3.86	1.00
		F	1.90	2.61	1.00
		G	-2.24	2.54	1.00
		H	-1.74	2.29	1.00
		I	.62	2.87	1.00
		J	-2.42	3.44	1.00
		K	-2.65	3.08	1.00
		L	-2.25	2.78	1.00

Appendix IV Mutilpe comparisons of the computer attitudes of different schools

Bonferroni

Dependent Variable	(I) Name of school	(J) Name of school	Mean Difference (I-J)	Std. Error	Sig.
computer confidence	E	A	-1.91	3.60	1.00
		B	-.92	3.71	1.00
		C	-4.14	3.53	1.00
		D	-.35	3.86	1.00
		F	1.55	3.66	1.00
		G	-2.59	3.62	1.00
		H	-2.10	3.44	1.00
		I	.26	3.86	1.00
		J	-2.77	4.29	1.00
		K	-3.00	4.01	1.00
		L	-2.60	3.78	1.00
	F	A	-3.46	2.22	1.00
		B	-2.47	2.38	1.00
		C	-5.69	2.10	.49
		D	-1.90	2.61	1.00
		E	-1.55	3.66	1.00
		G	-4.14	2.24	1.00
		H	-3.65	1.94	1.00
		I	-1.29	2.61	1.00
		J	-4.32	3.22	1.00
		K	-4.55	2.84	1.00
		L	-4.15	2.50	1.00
	G	A	.68	2.14	1.00
		B	1.67	2.31	1.00
		C	-1.54	2.02	1.00
		D	2.24	2.54	1.00
		E	2.59	3.62	1.00
		F	4.14	2.24	1.00
		H	.49	1.85	1.00
		I	2.85	2.54	1.00
		J	-.18	3.16	1.00
		K	-.41	2.78	1.00
		L	-.01	2.43	1.00
	H	A	.19	1.83	1.00
		B	1.18	2.02	1.00
		C	-2.04	1.68	1.00
		D	1.74	2.29	1.00
		E	2.10	3.44	1.00
		F	3.65	1.94	1.00
		G	-.49	1.85	1.00
		I	2.36	2.29	1.00
		J	-.67	2.96	1.00
		K	-.90	2.54	1.00
		L	-.50	2.16	1.00

Appendix IV Mutilpe comparisons of the computer attitudes of different schools

Bonferroni

Dependent Variable	(I) Name of school	(J) Name of school	Mean Difference (I-J)	Std. Error	Sig.
computer confidence	I	A	-2.17	2.52	1.00
		B	-1.18	2.67	1.00
		C	-4.40	2.42	1.00
		D	-.62	2.87	1.00
		E	-.26	3.86	1.00
		F	1.29	2.61	1.00
		G	-2.85	2.54	1.00
		H	-2.36	2.29	1.00
		J	-3.03	3.44	1.00
		K	-3.26	3.08	1.00
		L	-2.86	2.78	1.00
	J	A	.86	3.15	1.00
		B	1.85	3.26	1.00
		C	-1.36	3.07	1.00
		D	2.42	3.44	1.00
		E	2.77	4.29	1.00
		F	4.32	3.22	1.00
		G	.18	3.16	1.00
		H	.67	2.96	1.00
		I	3.03	3.44	1.00
		K	-.23	3.61	1.00
		L	.17	3.35	1.00
	K	A	1.09	2.76	1.00
		B	2.08	2.89	1.00
		C	-1.14	2.67	1.00
		D	2.65	3.08	1.00
		E	3.00	4.01	1.00
		F	4.55	2.84	1.00
		G	.41	2.78	1.00
		H	.90	2.54	1.00
		I	3.26	3.08	1.00
		J	.23	3.61	1.00
		L	.40	2.99	1.00
	L	A	.69	2.41	1.00
		B	1.68	2.56	1.00
		C	-1.54	2.31	1.00
		D	2.25	2.78	1.00
		E	2.60	3.78	1.00
		F	4.15	2.50	1.00
		G	8.70E-03	2.43	1.00
		H	.50	2.16	1.00
		I	2.86	2.78	1.00
		J	-.17	3.35	1.00
		K	-.40	2.99	1.00

Appendix IV Mutilpe comparisons of the computer attitudes of different schools

Bonferroni

Dependent Variable	(I) Name of school	(J) Name of school	Mean Difference (I-J)	Std. Error	Sig.
Computer Liking	A	B	1.15	1.86	1.00
		C	-.76	1.62	1.00
		D	2.90	2.05	1.00
		E	1.41	2.93	1.00
		F	5.16	1.80	.31
		G	1.34	1.74	1.00
		H	.82	1.48	1.00
		I	3.75	2.05	1.00
		J	-1.65	2.56	1.00
		K	-2.39	2.24	1.00
		L	.28	1.96	1.00
	B	A	-1.15	1.86	1.00
		C	-1.91	1.76	1.00
		D	1.75	2.17	1.00
		E	.26	3.01	1.00
		F	4.01	1.94	1.00
		G	.19	1.87	1.00
		H	-.33	1.64	1.00
		I	2.59	2.17	1.00
		J	-2.80	2.65	1.00
		K	-3.54	2.35	1.00
		L	-.88	2.08	1.00
	C	A	.76	1.62	1.00
		B	1.91	1.76	1.00
		D	3.66	1.97	1.00
		E	2.17	2.87	1.00
		F	5.92*	1.71	.04
		G	2.10	1.64	1.00
		H	1.58	1.37	1.00
		I	4.51	1.97	1.00
		J	-.89	2.49	1.00
		K	-1.63	2.17	1.00
		L	1.03	1.87	1.00
	D	A	-2.90	2.05	1.00
		B	-1.75	2.17	1.00
		C	-3.66	1.97	1.00
		E	-1.49	3.13	1.00
		F	2.26	2.12	1.00
		G	-1.56	2.07	1.00
		H	-2.08	1.86	1.00
		I	.85	2.34	1.00
		J	-4.55	2.79	1.00
		K	-5.29	2.51	1.00
		L	-2.63	2.26	1.00

Appendix IV Mutilpe comparisons of the computer attitudes of different schools

Bonferroni

Dependent Variable	(I) Name of school	(J) Name of school	Mean Difference (I-J)	Std. Error	Sig.
Computer Liking	E	A	-1.41	2.93	1.00
		B	-.26	3.01	1.00
		C	-2.17	2.87	1.00
		D	1.49	3.13	1.00
		F	3.75	2.98	1.00
		G	-.07	2.94	1.00
		H	-.59	2.80	1.00
		I	2.34	3.13	1.00
		J	-3.06	3.49	1.00
		K	-3.80	3.26	1.00
		L	-1.13	3.08	1.00
	F	A	-5.16	1.80	.31
		B	-4.01	1.94	1.00
		C	-5.92*	1.71	.04
		D	-2.26	2.12	1.00
		E	-3.75	2.98	1.00
		G	-3.82	1.82	1.00
		H	-4.34	1.58	.43
		I	-1.41	2.12	1.00
		J	-6.81	2.62	.65
		K	-7.55	2.31	.08
		L	-4.88	2.03	1.00
	G	A	-1.34	1.74	1.00
		B	-.19	1.87	1.00
		C	-2.10	1.64	1.00
		D	1.56	2.07	1.00
		E	.07	2.94	1.00
		F	3.82	1.82	1.00
		H	-.52	1.51	1.00
		I	2.41	2.07	1.00
		J	-2.99	2.57	1.00
		K	-3.73	2.26	1.00
		L	-1.06	1.98	1.00
	H	A	-.82	1.48	1.00
		B	.33	1.64	1.00
		C	-1.58	1.37	1.00
		D	2.08	1.86	1.00
		E	.59	2.80	1.00
		F	4.34	1.58	.43
		G	.52	1.51	1.00
		I	2.93	1.86	1.00
		J	-2.47	2.41	1.00
		K	-3.21	2.07	1.00
		L	-.55	1.76	1.00

Appendix IV Mutilpe comparisons of the computer attitudes of different schools

Bonferroni

Dependent Variable	(I) Name of school	(J) Name of school	Mean Difference (I-J)	Std. Error	Sig.
Computer Liking	I	A	-3.75	2.05	1.00
		B	-2.59	2.17	1.00
		C	-4.51	1.97	1.00
		D	-.85	2.34	1.00
		E	-2.34	3.13	1.00
		F	1.41	2.12	1.00
		G	-2.41	2.07	1.00
		H	-2.93	1.86	1.00
		J	-5.40	2.79	1.00
		K	-6.14	2.51	.99
		L	-3.47	2.26	1.00
	J	A	1.65	2.56	1.00
		B	2.80	2.65	1.00
		C	.89	2.49	1.00
		D	4.55	2.79	1.00
		E	3.06	3.49	1.00
		F	6.81	2.62	.65
		G	2.99	2.57	1.00
		H	2.47	2.41	1.00
		I	5.40	2.79	1.00
		K	-.74	2.94	1.00
		L	1.92	2.73	1.00
	K	A	2.39	2.24	1.00
		B	3.54	2.35	1.00
		C	1.63	2.17	1.00
		D	5.29	2.51	1.00
		E	3.80	3.26	1.00
		F	7.55	2.31	.08
		G	3.73	2.26	1.00
		H	3.21	2.07	1.00
		I	6.14	2.51	.99
		J	.74	2.94	1.00
		L	2.67	2.43	1.00
	L	A	-.28	1.96	1.00
		B	.88	2.08	1.00
		C	-1.03	1.87	1.00
		D	2.63	2.26	1.00
		E	1.13	3.08	1.00
		F	4.88	2.03	1.00
		G	1.06	1.98	1.00
		H	.55	1.76	1.00
		I	3.47	2.26	1.00
		J	-1.92	2.73	1.00
		K	-2.67	2.43	1.00

Appendix IV Mutilpe comparisons of the computer attitudes of different schools

Bonferroni

Dependent Variable	(I) Name of school	(J) Name of school	95% Confidence Interval	
			Lower Bound	Upper Bound
computer anxiety	A	B	-4.26	9.62
		C	-6.79	5.31
		D	-2.61	12.73
		E	-9.25	12.64
		F	-.85	12.63
		G	-6.90	6.09
		H	-3.50	7.59
		I	-5.30	10.04
		J	-9.13	10.00
		K	-10.39	6.37
		L	-5.17	9.49
	B	A	-9.62	4.26
		C	-10.02	3.18
		D	-5.72	10.48
		E	-12.25	10.27
		F	-4.02	10.45
		G	-10.09	3.92
		H	-6.77	5.50
		I	-8.42	7.79
		J	-12.16	7.67
		K	-13.47	4.09
		L	-8.31	7.26
	C	A	-5.31	6.79
		B	-3.18	10.02
		D	-1.56	13.16
		E	-8.30	13.16
		F	.25	13.02
		G	-5.79	6.46
		H	-2.32	7.90
		I	-4.25	10.47
		J	-8.14	10.49
		K	-9.37	6.83
		L	-4.10	9.90
	D	A	-12.73	2.61
		B	-10.48	5.72
		C	-13.16	1.56
		E	-15.09	8.35
		F	-7.10	8.76
		G	-13.19	2.26
		H	-9.96	3.93
		I	-11.43	6.04
		J	-15.06	5.81
		K	-16.43	2.30
		L	-11.34	5.53

Appendix IV Mutilpe comparisons of the computer attitudes of different schools

Bonferroni

Dependent Variable	(I) Name of school	(J) Name of school	95% Confidence Interval	
			Lower Bound	Upper Bound
computer anxiety	E	A	-12.64	9.25
		B	-10.27	12.25
		C	-13.16	8.30
		D	-8.35	15.09
		F	-6.93	15.33
		G	-13.08	8.89
		H	-10.10	10.81
		I	-11.04	12.39
		J	-14.29	11.78
		K	-15.90	8.50
		L	-11.03	11.96
	F	A	-12.63	.85
		B	-10.45	4.02
		C	-13.02	-.25
		D	-8.76	7.10
		E	-15.33	6.93
		G	-13.10	.51
		H	-9.75	2.06
		I	-11.46	4.41
		J	-15.24	4.32
		K	-16.52	.72
		L	-11.34	3.87
	G	A	-6.09	6.90
		B	-3.92	10.09
		C	-6.46	5.79
		D	-2.26	13.19
		E	-8.89	13.08
		F	-.51	13.10
		H	-3.18	8.08
		I	-4.95	10.50
		J	-8.77	10.45
		K	-10.04	6.83
		L	-4.83	9.95
	H	A	-7.59	3.50
		B	-5.50	6.77
		C	-7.90	2.32
		D	-3.93	9.96
		E	-10.81	10.10
		F	-2.06	9.75
		G	-8.08	3.18
		I	-6.62	7.27
		J	-10.61	7.38
		K	-11.78	3.67
		L	-6.46	6.68

Appendix IV Mutilpe comparisons of the computer attitudes of different schools

Bonferroni

Dependent Variable	(I) Name of school	(J) Name of school	95% Confidence Interval	
			Lower Bound	Upper Bound
computer anxiety	I	A	-10.04	5.30
		B	-7.79	8.42
		C	-10.47	4.25
		D	-6.04	11.43
		E	-12.39	11.04
		F	-4.41	11.46
		G	-10.50	4.95
		H	-7.27	6.62
		J	-12.37	8.50
		K	-13.74	4.99
		L	-8.65	8.23
	J	A	-10.00	9.13
		B	-7.67	12.16
		C	-10.49	8.14
		D	-5.81	15.06
		E	-11.78	14.29
		F	-4.32	15.24
		G	-10.45	8.77
		H	-7.38	10.61
		I	-8.50	12.37
		K	-13.42	8.53
		L	-8.47	11.92
	K	A	-6.37	10.39
		B	-4.09	13.47
		C	-6.83	9.37
		D	-2.30	16.43
		E	-8.50	15.90
		F	-.72	16.52
		G	-6.83	10.04
		H	-3.67	11.78
		I	-4.99	13.74
		J	-8.53	13.42
		L	-4.92	13.26
	L	A	-9.49	5.17
		B	-7.26	8.31
		C	-9.90	4.10
		D	-5.53	11.34
		E	-11.96	11.03
		F	-3.87	11.34
		G	-9.95	4.83
		H	-6.68	6.46
		I	-8.23	8.65
		J	-11.92	8.47
		K	-13.26	4.92

Appendix IV Mutilpe comparisons of the computer attitudes of different schools

Bonferroni

Dependent Variable	(I) Name of school	(J) Name of school	95% Confidence Interval	
			Lower Bound	Upper Bound
computer confidence	A	B	-6.82	8.79
		C	-9.04	4.58
		D	-7.07	10.18
		E	-10.40	14.22
		F	-4.12	11.04
		G	-7.99	6.62
		H	-6.43	6.05
		I	-6.45	10.79
		J	-11.62	9.89
		K	-10.52	8.33
		L	-8.93	7.55
	B	A	-8.79	6.82
		C	-10.63	4.21
		D	-8.55	9.68
		E	-11.74	13.58
		F	-5.66	10.61
		G	-9.55	6.21
		H	-8.08	5.73
		I	-7.93	10.30
		J	-13.00	9.30
		K	-11.95	7.80
		L	-10.43	7.08
	C	A	-4.58	9.04
		B	-4.21	10.63
		D	-4.49	12.06
		E	-7.93	16.20
		F	-1.50	12.87
		G	-5.35	8.44
		H	-3.71	7.78
		I	-3.88	12.67
		J	-9.11	11.84
		K	-7.97	10.24
		L	-6.34	9.41
	D	A	-10.18	7.07
		B	-9.68	8.55
		C	-12.06	4.49
		E	-12.82	13.53
		F	-7.02	10.82
		G	-10.93	6.45
		H	-9.56	6.07
		I	-9.21	10.44
		J	-14.16	9.32
		K	-13.18	7.89
		L	-11.73	7.24

Appendix IV Mutilpe comparisons of the computer attitudes of different schools

Bonferroni

Dependent Variable	(I) Name of school	(J) Name of school	95% Confidence Interval	
			Lower Bound	Upper Bound
computer confidence	E	A	-14.22	10.40
		B	-13.58	11.74
		C	-16.20	7.93
		D	-13.53	12.82
		F	-10.97	14.07
		G	-14.95	9.76
		H	-13.85	9.66
		I	-12.92	13.44
		J	-17.43	11.89
		K	-16.72	10.72
		L	-15.53	10.33
	F	A	-11.04	4.12
		B	-10.61	5.66
		C	-12.87	1.50
		D	-10.82	7.02
		E	-14.07	10.97
		G	-11.80	3.51
		H	-10.29	3.00
		I	-10.21	7.63
		J	-15.32	6.68
		K	-14.25	5.15
		L	-12.70	4.40
	G	A	-6.62	7.99
		B	-6.21	9.55
		C	-8.44	5.35
		D	-6.45	10.93
		E	-9.76	14.95
		F	-3.51	11.80
		H	-5.84	6.82
		I	-5.84	11.54
		J	-10.99	10.63
		K	-9.89	9.08
		L	-8.32	8.30
	H	A	-6.05	6.43
		B	-5.73	8.08
		C	-7.78	3.71
		D	-6.07	9.56
		E	-9.66	13.85
		F	-3.00	10.29
		G	-6.82	5.84
		I	-5.45	10.17
		J	-10.79	9.44
		K	-9.59	7.79
		L	-7.89	6.89

Appendix IV Mutilpe comparisons of the computer attitudes of different schools

Bonferroni

Dependent Variable	(I) Name of school	(J) Name of school	95% Confidence Interval	
			Lower Bound	Upper Bound
computer confidence	I	A	-10.79	6.45
		B	-10.30	7.93
		C	-12.67	3.88
		D	-10.44	9.21
		E	-13.44	12.92
		F	-7.63	10.21
		G	-11.54	5.84
		H	-10.17	5.45
		J	-14.77	8.71
		K	-13.79	7.27
		L	-12.35	6.63
	J	A	-9.89	11.62
		B	-9.30	13.00
		C	-11.84	9.11
		D	-9.32	14.16
		E	-11.89	17.43
		F	-6.68	15.32
		G	-10.63	10.99
		H	-9.44	10.79
		I	-8.71	14.77
		K	-12.57	12.11
		L	-11.29	11.63
	K	A	-8.33	10.52
		B	-7.80	11.95
		C	-10.24	7.97
		D	-7.89	13.18
		E	-10.72	16.72
		F	-5.15	14.25
		G	-9.08	9.89
		H	-7.79	9.59
		I	-7.27	13.79
		J	-12.11	12.57
		L	-9.82	10.62
	L	A	-7.55	8.93
		B	-7.08	10.43
		C	-9.41	6.34
		D	-7.24	11.73
		E	-10.33	15.53
		F	-4.40	12.70
		G	-8.30	8.32
		H	-6.89	7.89
		I	-6.63	12.35
		J	-11.63	11.29
		K	-10.62	9.82

Appendix IV Mutilpe comparisons of the computer attitudes of different schools

Bonferroni

Dependent Variable	(I) Name of school	(J) Name of school	95% Confidence Interval	
			Lower Bound	Upper Bound
Computer Liking	A	B	-5.19	7.50
		C	-6.29	4.77
		D	-4.11	9.91
		E	-8.60	11.41
		F	-1.00	11.32
		G	-4.60	7.28
		H	-4.25	5.89
		I	-3.26	10.75
		J	-10.39	7.09
		K	-10.05	5.27
		L	-6.42	6.97
	B	A	-7.50	5.19
		C	-7.94	4.12
		D	-5.66	9.15
		E	-10.03	10.54
		F	-2.61	10.62
		G	-6.22	6.59
		H	-5.94	5.28
		I	-4.81	10.00
		J	-11.87	6.26
		K	-11.57	4.48
		L	-7.99	6.24
	C	A	-4.77	6.29
		B	-4.12	7.94
		D	-3.06	10.38
		E	-7.64	11.97
		F	.08	11.75
		G	-3.50	7.70
		H	-3.09	6.25
		I	-2.22	11.23
		J	-9.40	7.63
		K	-9.03	5.77
		L	-5.37	7.43
	D	A	-9.91	4.11
		B	-9.15	5.66
		C	-10.38	3.06
		E	-12.20	9.22
		F	-4.99	9.51
		G	-8.62	5.50
		H	-8.43	4.27
		I	-7.14	8.83
		J	-14.09	4.99
		K	-13.85	3.27
		L	-10.34	5.09

Appendix IV Mutilpe comparisons of the computer attitudes of different schools

Bonferroni

Dependent Variable	(I) Name of school	(J) Name of school	95% Confidence Interval	
			Lower Bound	Upper Bound
Computer Liking	E	A	-11.41	8.60
		B	-10.54	10.03
		C	-11.97	7.64
		D	-9.22	12.20
		F	-6.42	13.92
		G	-10.11	9.97
		H	-10.14	8.97
		I	-8.37	13.05
		J	-14.97	8.86
		K	-14.95	7.35
		L	-11.64	9.37
	F	A	-11.32	1.00
		B	-10.62	2.61
		C	-11.75	-.08
		D	-9.51	4.99
		E	-13.92	6.42
		G	-10.04	2.40
		H	-9.74	1.06
		I	-8.66	5.84
		J	-15.74	2.13
		K	-15.43	.33
		L	-11.83	2.07
	G	A	-7.28	4.60
		B	-6.59	6.22
		C	-7.70	3.50
		D	-5.50	8.62
		E	-9.97	10.11
		F	-2.40	10.04
		H	-5.66	4.63
		I	-4.65	9.47
		J	-11.77	5.80
		K	-11.44	3.98
		L	-7.82	5.69
	H	A	-5.89	4.25
		B	-5.28	5.94
		C	-6.25	3.09
		D	-4.27	8.43
		E	-8.97	10.14
		F	-1.06	9.74
		G	-4.63	5.66
		I	-3.42	9.27
		J	-10.69	5.75
		K	-10.27	3.85
		L	-6.55	5.46

Appendix IV Mutilpe comparisons of the computer attitudes of different schools

Bonferroni

Dependent Variable	(I) Name of school	(J) Name of school	95% Confidence Interval	
			Lower Bound	Upper Bound
Computer Liking	I	A	-10.75	3.26
		B	-10.00	4.81
		C	-11.23	2.22
		D	-8.83	7.14
		E	-13.05	8.37
		F	-5.84	8.66
		G	-9.47	4.65
		H	-9.27	3.42
		J	-14.94	4.14
		K	-14.70	2.42
		L	-11.18	4.24
	J	A	-7.09	10.39
		B	-6.26	11.87
		C	-7.63	9.40
		D	-4.99	14.09
		E	-8.86	14.97
		F	-2.13	15.74
		G	-5.80	11.77
		H	-5.75	10.69
		I	-4.14	14.94
		K	-10.77	9.29
		L	-7.39	11.24
	K	A	-5.27	10.05
		B	-4.48	11.57
		C	-5.77	9.03
		D	-3.27	13.85
		E	-7.35	14.95
		F	-.33	15.43
		G	-3.98	11.44
		H	-3.85	10.27
		I	-2.42	14.70
		J	-9.29	10.77
		L	-5.64	10.97
	L	A	-6.97	6.42
		B	-6.24	7.99
		C	-7.43	5.37
		D	-5.09	10.34
		E	-9.37	11.64
		F	-2.07	11.83
		G	-5.69	7.82
		H	-5.46	6.55
		I	-4.24	11.18
		J	-11.24	7.39
		K	-10.97	5.64

*. The mean difference is significant at the .05 level.

Appendix V Interview Data Display

The interviewees' responses are categorised and displayed in matrices under different headings, which indicate various aspects of their incorporation of IT in teaching. The respondents' names are represented by English letters to ensure anonymity in each matrix.

Advantages of using IT in teaching

Respondent	Self-access work	Students more active/ more interaction	Abundant authentic materials from the Net	Motivating/ more effective teaching	Use of multi-media materials	Effective use of teaching materials	Breakthrough the constraints of the classroom	others
A	*"Students can browse websites and collect more information in their daily life."*		*"can collect a lot of useful materials from the Web within a short time"*	*"better grasp the concepts which cannot be verbally explained clearly"*				
B				*"Students feel more interested with more audio-visual elements in the lesson."*	*"Move diversified audio-visual materials, comics, music, pictures, etc. can be used.(e.g. songs and photos of Kuomintang)"*	*"Can adapt and recycle materials/PPT easily."*		
C				*"better grasp abstract concepts in Physics."* *"students easily fall asleep with just chalk and talk"*	*"...Use of films and sound is possible."*	*"In principle PPT is prepared once for different classes and for several years"* *"easy storage... the transparencies are difficult to keep"* *"just scroll up and down the screen but the*	*"Bring students outside of the classroom, putting them in different situations to experience things they need to learn...difficu*	

						blackboard writing may have been erased.	*lt to realise this in the limited setting of the classroom."*	
D				*"better visual effect than the books and transparencies, the pictures are large and clear on the screen; hence better teaching effect"* *" easier to grasp abstract concepts, more works can be illustrated; thus more involved in lessons"*	*"Students are interested in watching images."*	*"More convenient and save time in preparing teaching aids with the digital camera...In the past, the slides and OHP had to be developed in special shops."* *"We can share works with other schools through the web."* *"Build up materials in a data bank... hey can accumulate and be recycled"* *"Videotape the demonstration process and the teacher don't have to repeat the demonstration five times(5 classes)"*		*"Post students' works on the Web and they feel happy."*
E	*"We can introduce some websites to students and they can browse them after class."*			*"Arouse motivation, more interesting"* *"not as accurate and tidy when you draw figures on the board"*	*"Use of film strips to demonstrate experiments."* *"can use graphs and images."*	*"can go back and forth, unlike with the blackboard"*	*"Can view experiments generally not done in class."*	*"Helpful to me when teaching a subject I did not major in. There's lots of supplements*

								and clear explanations"
F				*"Easy to focus students"* *"Good to teach reading comprehension and vocabulary with the passage on the screen."*		*"Prepare the material in advance and you just follow the PPT in class, there's a clear flow."*	*"The video clip can bring students out of the classroom."*	
G				*"The use of IT promotes motivation and interest in the learning process...It helps students to understand the theories better through visual aids and interactive methods."*		*"More convenient, recycle material in different classes and it saves time."*		*"The PPT reminds me of minor points I may forget."*
H	*"Further explore the websites after class in self access mode"*	*"More interactive"*		*"It would increase their interest."*				
No. of respondents	3	1	1	8	4	6	3	3

Difficulties in using IT

Respondent	Equipment	Reliability of computers	Lack of IT skills	Lack of time	Resources
A	*"You always have to carry the equipment to the classroom .The setting up is also very disturbing to students."*	*"The computer is very unreliable sometimes."*			
B			*"Limited ability to grasp the software"*	*"not enough time to prepare...the planning is so much more complicated than just a lesson of chalk and talk"*	
C	*"You cannot use it when there is no computer or network in that classroom."*			*"there're too many requirements on teachers. Teaching is a very demanding job. Time is needed to prepare for the lessons."*	
D			*"I need more skills to make more sophisticated PPT and teaching materials."*	*"there're so many resources on the web but I can't use them directly. I need time to adapt them but it's often not enough."* *"If I have time to learn more IT skills, I want to include animation in my lessons."*	
E		*"Sometimes the computer is unreliable but it's not a big problem."*			
F	*"You have to book the equipment if you want to use the computer in the classroom."*			*"It's really rather time-consuming to build up the data bank...you spend a lot of time browsing the materials."*	
G	*"Mainly the set up of the LCD takes time...maybe there are not enough notebooks to borrow."*			*"You need much more than a lesson's time in preparing for a lesson's material...drawing, searching for information, reading books... A lot of time is needed."* *"In principle it saves time if it's used for many years...but the syllabus changes all the time..."*	

H	*"Sometimes the equipment is not available, you just need the incentive to use it."*	*"The computer does not work and when you try to get the IT coordinator , he's not available."*			*"You see I have to teach two classes of History, one in English and the other one in Chinese. Most of the materials are in English. There're not adequate materials in Chinese."*
	5	*3*	*2*	*5*	*1*

Drawbacks of using IT in teaching

Respondent	Should not be made mandatory	Physical effects	Adverse effect on students' learning	Breakdown of equipment	Lack of flexibility and effect on teaching progress	others
A	*"Only a tool, different teachers have different teaching styles and IT should be used selectively according to needs. If made compulsory for all teachers... tail wagging the dog."*		*"the glut of information can be confusing for students"*			
B		*"When the lights are out, students can feel tired."*	*"Students are used to multimedia and diversity. When the teacher goes back to the textbook, they'll find it monotonous and boring".*			
C			*"Students are used to appealing PPT, animation and will easily get bored with non images, they can't easily focus on texts, reading, deep processing thinking etc."* *"Students' power of expression declines." (ICQ language...poor grammar)* *"Used to the environment at the click of a button, they can't easily focus on texts, reading, deep processing thinking etc.* *IT is good for initiation, quick and appealing, but the charts and images are superficial, need deeper processing in learning, reading skills to dig into issues, analytical power and a good power of expression."* *"It affects their reading skills."*			*"The web sites are mostly in English, both students and I have to upgrade our English."*
D			*"Used to graphics and sounds, don't like reading....as a result their concepts are superficial and not clear"*	*"Not as secure as textbooks for the*		

			"They think they understand the concept after browsing the graphics but in fact without reading their concept is not well-grounded."	*machine can break down. Too much reliance will affect the lesson."*		
E			*"Students get bored with IT if it is used for a long time, so you have to intersperse IT with normal practice."*		*"Difficult to amend the prepared materials in class."*	
F		*"Harmful to the eyes...too much visual input."*			*"Prepared materials have too much control on the teaching process and the sequence assuming there's a package students have to learn... students become passive* *" Contrary to the spirit of language teaching: small tasks , lots of interaction and even physical movements."* *"so troublesome setting up the computer, so tend to use longer time for PPT presentation."*	
G				*"Can waste half a lesson on a technical problem"*		*"Students in HK are used to being spoonfed. They are passive, not used to this mode of teaching...which requires active search of information"*

H					*Affect teaching progress. Spend a lot of lesson time only achieving a small part*	
No. of respondents	*1*	*2*	*5*	*2*	*3*	*2*

Change in roles of the teacher and the student

	YES	NO
A		*"It does facilitate information gathering but it is after all a medium, a vehicle like the textbook. It may be more active and updated but it is still up to the teacher to elaborate and analyse the topic."*
B		*"Not much change, similar to before, only more diversified now in terms of teaching materials."*
C	*"Constantly changing, not teachers doing all the work, teaching everything."*	
D		*"Not much change, only use another medium to guide students, maybe a better guide than before. Students are relatively more active than before and participate more, and they have access to more materials."*
E		*"Not much change in the role; but can make students learn more actively. They can access extra exercises on the server. There are more opportunities to learn."*
F		*"Only a teaching aid, there's not much change in the role. In fact the use of IT in language learning is teacher-centred, incompatible with the current trend ---learner-based."*
G		*"Not much change. Students do classwork and teachers observe and give support."*
H	*"Yes if the targets of using IT are achieved."*	
No. of respondents	*2*	*6*

IT and the subject taught

Subject category	(no. of respondents teaching that subject)	Amount of resources available	Subject-related difficulties	Types of applications used	Successful examples of integration	Ways to enhance better integration in the subject
Language subjects	English (n=1)	Reasonable (p&w)	**Lack of practice** *"IT serves to present grammar items clearly but it doesn't contribute to practice and interaction which is vital to language learning"* *"IT plays only a small part in language teaching."*	PPT Intranet	Grammar teaching *"Good for teaching grammar... students like the attractive pictures."* Teaching passages *"highlight the topic sentences, the specific sentences and the connectives and show the relationship."* Checking answers *"...post answer keys on the server for students to access themselves."*	Improve on interactivity of software Build up a resource data bank for the dept.
	Chinese (n=2)	Limited (p &w) *"unlike Biology, Geography which are world-wide subjects, the subject is mostly confined to Chinese communities. Resources are developed much later than other countries"*	Time constraint *"have to look to publishers or even other teachers to develop more resources."*	WP, WB,PPT	The introduction to Chinese characters *"the CD-ROM clearly illustrates the interesting aspects with games :the order of brush strokes, the development and the pronunciation of characters."*	Develop more updated resources Improve on interactivity of software

Social sciences	Chinese History (n=3)	Limited (p &w) *"difficult to find pictures, songs or information from the Web except for modern history."* *"not many resources, only one relatively good set developed with QE fund ."*	Time constraint *"Only use ready-made materials. It's time-consuming to make your own things... can't afford the time."*	PPT, Web	History of Kuomingtang *"Show the songs of the age and conversation excerpts of the important figures. Arouse motivation."* *"illustrate the complex systems of different dynasties on the charts on PPT...easy to make comparison."*	Improve on interactivity of software *"Don't just present ideas. Let students participate in interactive software."* *"students can play the role of the king in the software and decide on the course of action to take; hence, more participation, more thinking."*
	History (n=1)	Abundant (w) "too much information on the web" inadequate(p)	Time constraint *"can find lots of information about a figure ...but has to spend a lot of time editing."* Language *"information is usually in English, of a level too difficult for our students."*	PPT, web browsing	WWI---Treaty of Versailles *"More interesting to show students the map and comic strips than just talk."*	Develop more resources *"More resources have to be developed by publishers or other educational organizations."*
	Economics (n=1)	Limited(w) Reasonable(p)	Not much of a problem using IT	Intranet (economic news posted for students)		

	Integrated Humanities (n=3)	Abundant(w) "*depends on EMB support because it's a new subject.*"		PPT Web browsing		Improve on interactivity of software *"Not just web- browsing and PPT, more interactive materials are needed"* *"Not just web browsing, IH stresses students' self-learning approach... should include more interactive elements."* *"More hardware support is needed so that students can have hands on experience."*
Sciences	Mathematics (n=2)	Reasonable (p)	"*not much of a problem*"	PPT mainly (CD-ROMs from publishers)	Pythagorus Theorem *"show students a film strip about the life of the mathematician to arouse their interest."* *Film also shows concrete evidence to prove the theory, good supplements ...don't have enough time, space and the tools necessary to prove the theory in the classroom."* *'there are more detailed steps and easier examples in the CD-ROMs than the textbook, good for remedial classes"*	Improve on interactivity of software *"More interactive materials needed, now only it's only for presentation."* Develop more resources "*The publishers need to produce PPT better grading to suit students of different abilities. Now teachers have to do the fine-tuning."*

	Physics (n=1)	Abundant (p & w) *"Many abstract concepts can be found on the websites. It' s amazing."* *"the publishers also provide rich materials & CD-ROMs."*	Time constraint *"Easy to apply IT to my subject but I just lack time to select the suitable materials."*	VCDs, PPT, animations, CD-ROMs,	*"The PPT works very well in illustrating the teaching content, the requirements and the syllabus."* *"it is useful in illustrating how to apply principles to problems."*	Analyse test results *"The diagnostic nature of the software can be further utilised to understand students' misconceptions (marking M.C. questions)* Generate tests *"More routine quizzes can be generated by drawing questions from the data bank...make sure students learn what they need to learn."*
	IT			Word Excel, computer skills, use of software,etc.		
	Integrated Science (n=2)	Limited(w) Abundant (p)	*"no big problem."*	PPT mainly (CD-ROMs from publishers)		

Cultural subjects	Art (n=1)	Abundant (w) Reasonable (p)	Time constraint *"can't produce by yourself all the time , time is limited, usually just use the publishers' materials."*	Mainly PPT	Demonstration of Installation art on the computer *"installation artworks are usually too big for the classroom and non-durable, so can't take students to the location"* Teaching fashion design *"First, I collected samples from the web, then I prepared exercises for students and arranged a fashion design competition using recyclable materials and lastly I posted the students' works on the web for display."*	Publish students' works *"It's good to display students' works on the web for exhibition and assessment but it takes time because the exhibition needs constant revision and updating."*
	P.E.(n=1)	Abundant(p) *"A lot of video clips prepared by the publishers"*	Only use IT once in a while e.g. on rainy days " … *won't take the trouble to set up equipment in the playground just for a 5 min film strip."* *"Students don't want to sit quietly during the PE lessons. Their idea of a PE lesson is to be on the move all the time."*	PPT	Sports safety knowledge, first aid knowledge, etc.	New approach of learning *'Students, parents need to change the concept about PE lessons. They don't just come to play… need to learn to appreciate and evaluate. They can appreciate the skills of a basketball player and learn from him… students' performance can also be videotaped and shown for peer assessment and IT does facilitate that."*
		P= from publishers W= from web sites				

Opinions about IT policy

Respondent	Resources	IT knowledge/training	Role of IT	Future trend
A	*"There should be people to develop resources. The government must give technical support and IT knowledge and not just invest in hardware."*	*"Enough to have basic skills, not every teacher has to know sophisticated skills. Teachers don't need to learn technical skills which are not required in their actual teaching."* *"IT knowledge has to catch up , not just hardware"*	*"Don't deify IT, only a tool like OHP* *Teacher's ability not embodied in IT ability. There should be no superstition with IT."* *"More than just a dynamic book, should be deeper and broader development."*	
B	*"Not enough support from EMB. Support to produce teaching materials/resources needed...* *can benefit all schools through sharing."*	*"Good to know basic skills(training)"*		
C			*"Don't deify IT, only a tool like OHP "* *"Students need to have the ability to learn. Students may appreciate the attractive images but not learn the content."* *"The question is to put more resources on how to help students learn better rather than investing too much on hardware."*	
D	*"Government should spend more on both software and hardware"* *"More money should be spent on the licences for software, e.g. Photoshop, Illustrator, Freehand, etc."*	*"good to have some basic training but there's no follow-up on the training given to teachers, don't know more advanced skill; e.g. video editing. Training should continue."*		

E	*"More resources should be provided. Teachers have no time to produce resources which cater for students of different standards and languages of instruction. There should be more variety and more choices."*	*"Good to acquire basic skills and be able to use IT today* *Increase in-service or pre-service training in IT, make it more practical and useful."*	*"the government should not force teachers to use IT...not every teacher has to use IT. Different teachers have different styles."* *Can teach well without IT*	
F	*"No follow-up in software and hardware."*			*"Still phobia among teachers because of the govt's mandate* *Once the checks and balance is gone, stop using it."* *"Not many teachers use IT except for some schools (Pui Ching)"* *"Discussion seems to have faded out. School-based or subject-based discussion on the use of IT is not enough."*
G	*"Quick supply of hardware. not enough room for teachers to catch up."*	*"There's some training but teachers are busy and technological development is very rapid."*		
H		*"Good to acquire some skills"*		